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FOREWORD

The 'Science Base' is defined in this report as the research and research training supported by the resources of the five Research Councils[1] and by the resources awarded to Higher Education Institutions (HEIs) by all other sources – including the Universities Funding Council (UFC), the Polytechnics and Colleges Funding Council (PCFC), Government departments, other public sector organisations, industry and other private bodies such as charities and overseas organisations.

In the United Kingdom (UK), much of the research contributing to the Science Base is carried out in HEIs, with the appropriate support of central facilities. Research is also undertaken in the Institutes and Laboratories of the Research Councils. International science, particularly within the European Community (EC), is of growing importance to the Science Base in the UK. However, the value of international scientific collaboration depends crucially on the presence of an adequate national effort in the field of interest.

This report concentrates on the national Science Base and in particular on the research carried out in the university institutions of the UK. The report does not include a study of Science Base research conducted in Polytechnics and other Higher Education Colleges. Research in these institutions was the subject of a separate study by the PCFC in September 1990.

The data used in the compilation of this report were accurate as of November 1990 and do not, therefore, reflect the 1991/92 and 1992/93 public expenditure settlements. The broad effect of the settlements is, however, reflected in the discussion.

In the course of the final preparation of this report the Government announced, in April 1992, the creation of an Office of Science and Technology (OST). The OST, which is headed by the Chief Scientific Adviser, assumed responsibility for the science budget and the five Research Councils. As a result of these changes in responsibility for science the former Department of Education and Science (DES) became the Department for Education (DFE), with responsiblity for the UFC. Under the Further and Higher Education Act 1992, the UFC (and the PCFC) will be succeeded, on 1 April 1993, by a Higher Education Funding Council for England, a Higher Education Funding Council for Wales and a Scottish Higher Education Funding Council.

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[1] Agricultural and Food Research Council (AFRC); Economic and Social Research Council (ESRC); Medical Research Council (MRC); Natural Environment Research Council (NERC); Science and Engineering Research Council (SERC).

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Summary of findings and recommendations

1. Over the past ten years or so, there have been considerable changes in the funding and organisation of academic science in the UK. Industry and charities now support a much larger share of research in HEIs than they did in earlier decades. This increase has been accompanied by a rapid growth in the number of short term research posts in universities. Over the same period, total funding for the Science Base has increased significantly in real terms. Despite these increases, however, budgets for Science Base research remain under pressure.

2. There has been a rapid growth in scientific opportunities and hence in the volume of research which HEIs would wish to undertake. In addition, the costs of undertaking advanced research at the frontiers of knowledge have risen faster than general inflation. As a consequence, the flexibility of HEIs to adapt to changing research needs and their ability to maintain the essential base for the support of research has been reduced.

3. Financial problems have been exacerbated by the failure of HEIs to identify and recover the full costs of sponsored research. This has been a factor in prompting the Committee of Vice Chancellors and Principals (CVCP) to review the costing of research in universities and the, then, DES to propose changes in the structure of research funding in HEIs by the Research Councils.

4. The Science Base has, for a number of years, found itself undertaking too much research for the available funding. It is essential that action is taken to address this imbalance and that future academic research is conducted on a sound financial basis. A number of measures will be required to remedy the present situation.

5. In drawing up the recommendations which follow, we have been guided by the principle that HEIs should know and account for the full costs of the research that they undertake. They may then choose what research, if any, they are able to support from their own resources.

6. Our main recommendations are:

Costs of research

6.1 Further to the recommendations made by the Hanham Committee, the Higher Education Funding Councils should urgently promote the introduction of standard bases for cost accounting in HEIs that will enable more informed decision making in relation to the costs of research.

6.2 Government departments, industry and charities should generally meet the full costs of the research they sponsor – with the exception of some research of mutual interest which HEIs are able partially to support from their own resources, and which should be separately accounted for and disclosed.

Science Base funding

6.3 In addressing the imbalance between funding and workload for the Science Base a combination of increased priority setting and greater selectivity, together with the provision of extra funding, will be required.

6.4 The Government should build on the 1992/93 public expenditure settlement by providing extra funding for the Science Base in future years, above the increase necessary to keep pace with inflation.

6.5 Although a large proportion of these extra funds should be allocated by the Research Councils, a significant fraction should be used to enhance the research funding element of the Higher Education Funding Councils' grants to enable HEIs to rebuild a firm foundation for Science Base research and to continue their restructuring process.

6.6 The Higher Education Funding Councils and the HEIs should ensure that the additional funds are used to improve the support given to existing staff and facilities, rather than to employ more researchers, and are allocated on the basis of the quality of the research undertaken.

6.7 The Higher Education Funding Councils should encourage greater university–industry interactions by further increases in the size of the research funding element which is related to the level of industrially funded research.

6.8 The Government should consider what measures can be taken to enable the HEIs and the Research Councils to plan more effectively for the Science Base in the longer term. This might include increasing the reserve that the Research Councils might carry forward to the following year, and the use of explicit common assumptions about future inflation and the Government's spending plans.

Careers in research

6.9 The HEIs should promote a better career structure for academic researchers in science and technology.

Greater salary differentials may be necessary to attract and retain outstanding scientists. Further thought needs to be given to career options which will enable promising young scientists to establish themselves in fields which will offer them the greatest scientific opportunities and, where appropriate, provide the necessary experience for a subsequent move to industry.

6.10 The levels of postgraduate awards should continue to be kept under review by the Research Councils.

1 Introduction

7. Science and technology make a major contribution to the well-being of all developed countries. No nation can hope to succeed in solving its technical and industrial problems without an adequate supply of highly trained scientists and technologists. Their contribution to the intellectual standing of the country, its industrial base and its infrastructure is immense.

8. Scientific and technological knowledge alone is not enough. It must be intelligently applied if it is to prove its value. But without it we shall not be able to compete internationally and sustain, let alone improve, our living standards. A significant measure of this country's well-being will come from the reinvestment into scientific research of the financial benefits arising from its application.

9. Substantial changes have taken place over the past ten years in the planning and conduct of academic science. The purpose of this ACOST study was to examine the effect of these changes and to make appropriate recommendations. The membership and terms of reference of the Study Group can be found in Appendix 1.

Background

10. The conduct of science is international and becoming increasingly so. The knowledge base itself is widely, almost universally, accessible. All civilised countries nevertheless recognise the need for a strong national Science Base. Through this they contribute to world knowledge and are able to access this universal knowledge base more effectively. The research groups which form the Science Base provide the training ground for scientists who may later carry out and manage research in industry.

11. Since basic research is in the nature of a public good, in the UK and elsewhere, it has largely been funded by Government. Spending constraints, as part of a wider policy of containing public expenditure, have had an effect on the level of research support and there have as a consequence been calls from the academic community for increased support from Government.

12. In addition, the Government has sought improvements in the management of research resources which are aimed at securing greater value for money from the sums currently invested. As a result, radical processes of change and adaptation have been required at a time when growth in resources has been limited and competition has remained strong. Opportunities as well as fields of interest have also multiplied, especially in the life sciences.

13. All these factors have put increasing strains upon the resources of the Science Base and upon those involved. The consequent problems which are most often perceived by researchers are considered in section 4 and Appendix 3.

14. Others have argued that at least some of the research community's dissatisfaction is the inevitable result of rapid changes in the nature and organisation of science itself. For two hundred years science has enjoyed a continuously expanding horizon of developments and opportunities. Many scientists who have experienced periods of rapid growth in funding have found it difficult to come to terms with the limits that now constrain it. Such disappointments are likely to continue until the full possibilities of sustaining dynamic research programmes within constrained resources come to be appreciated.

The Changing Pattern of Academic Science

15. As the Chairmen of the Advisory Council for Applied Research and Development (ACARD) and the Advisory Board for the Research Councils (ABRC) indicated in their 1986

report on "The Science Base and Industry", the rapid expansion in science funding which occurred in this century levelled off in the mid-seventies. The ensuing constraints led to demands for more selectivity in the support of research. At the same time, increased concern was voiced about the UK's ineffectiveness in exploiting its basic research. HEIs were therefore encouraged to seek closer collaboration with industry.

16. Since then the growth in support from industry and charities for university based research has been encouraging. In many cases it has required from academic staff a more externally focused approach in their research objectives in order to fulfil a more specific remit. The support from industry is not confined to research. A report by The Council for Industry and Higher Education (CIHE) indicates that teaching attracts greater support than research, student sponsorship alone attracting about £76m.

17. Another significant development has been the concentration of research workers into groups, often as a result of the growth of more demanding techniques necessitating large instruments and the teams to run them. The work undertaken by such groups often calls for a mixture of scientific research and technological development and requires a broad range of skills not found within a single discipline.

18. This collective activity is not limited to large-scale research, for example the European Organisation for Nuclear Research (CERN), but also occurs in subjects such as microbiology, where increasingly sophisticated apparatus is needed to pursue new scientific opportunities. The larger groups are able to employ specialised facilities in a more efficient way. Wide-ranging interactions with other scientists and other disciplines are also often essential for progress. These trends are reflected in the rise in the number of multi-authored papers and were the main reasons for the establishment of Interdisciplinary Research Centres.

2 Trends in the UK Science Base

19. The ACOST Study Group commissioned the Science and Engineering Policy Studies Unit (SEPSU) to collect information on the changes in funding and manpower of the Science Base over recent years. All numbered Figures and Tables refer to the SEPSU Report which is attached as Appendix 2. Detailed information on polytechnics was not included because a study of the level of research in this sector had recently been undertaken by the PCFC. Although growing markedly it is, as yet, small compared with that in the university sector. The Further and Higher Education Act 1992 removed the "binary line" between universities and other HEIs. In principle, this should enable polytechnics and other colleges to compete on a more equal basis for Research Council funds.

20. The report shows that the income of the Science Base from all sources increased by 32% in real terms in the eleven years from 1977/78 to 1988/89. DES funding of the Science Base increased in real terms over the same period by some 16%.

21. As the report makes clear, both of these real increases are based on calculations using the Gross Domestic Product (GDP) deflator to compensate for the average annual effects of inflation. This approach is adopted throughout this paper since it is general Government practice. However, the GDP deflator may not be the most appropriate factor to apply to specialised activities such as research. An alternative is the Universities Pay and Prices Indicator (UPPI) which covers activities other than research but nevertheless more accurately reflects universities' (and other HEIs') costs. Since these costs have increased faster than the general rate of inflation, use of this indicator gives a less favourable view of trends in the funding of the Science Base. For example, on this basis, funding by the DES over the period 1977/78 to 1989/90 only slightly increased purchasing power. Other GDP deflator funding trends quoted in this report overestimate the increases in terms of actual purchasing power. The variation in the income of the UK Science Base from DES sources, adjusted by the GDP deflator and the UPPI index, is shown in Figure A (data from Table 2.3).

22. The part of the Government grant to the UGC/UFC[2] which has supported the Science Base is estimated to have increased by 13% in real (GDP deflator) terms between 1977/78 and 1988/89 but this increase was expected to be lost by 1991/92. However, in UPPI terms the purchasing power of the grant actually decreased by 3%. However, there are some uncertainties in the estimation of the UFC grant for future years and the figures (Table 2.4) should therefore be viewed with some caution. The same comment applies to Figure A, where the error bars show the effect of a 10% variation in the UFC forward estimates.

23. The Science Budget (essentially the income of the Research Councils from the DES) increased by some 19% in real (GDP deflator) terms between 1977/78 and 1988/89. Again, in UPPI terms the increase was only 1%.

24. The research income of the universities, excluding UGC contributions but including contributions from the Science Budget and other sources, has increased by 96% in real (GDP deflator) terms between 1980/81 and 1988/89 (table 2.7). This is due partly to the increased contributions from the Research Councils and Government departments, but more particularly to a steep increase in research funding from industry and charities. Increased funding from these sources, whilst welcome, may have attached constraints for the universities, being selective in academic discipline, and in some cases favouring applied over basic research. As discussed later, in many cases the funding has also not covered the full costs of the research it was intended to support.

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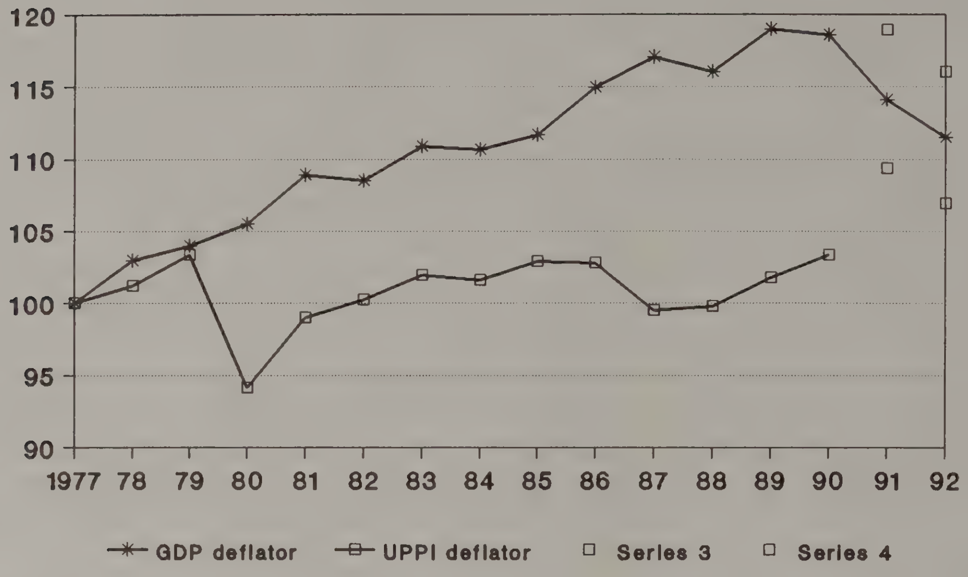
[2] Since 1 April 1989, by virtue of the Education Reform Act 1988, the Universities Funding Council (UFC) has administered funds made available by the Secretary of State for Education and Science for the provision of education and the undertaking of research by universities. Previously the Secretary of State was advised on the distribution of funds by the University Grants Committee (UGC).

Figure A - UK Science Base Income from DES sources adjusted by GDP and UPPI indices (1977/78 = 100)



Source: SEPSU Table 2.4

25. The number of full-time university staff (all subjects) funded from UGC/UFC sources has declined by 5% since 1977/78, but the number of (primarily short term) staff supported from other funds has increased by 138% over the same period. Expenditure on technical support staff has decreased by 13% in real terms between 1980/81 and 1989/90 (tables 4.2 and 3.9). The fact that this decrease has accompanied an increase in researchers is a continuing source of operational difficulties.

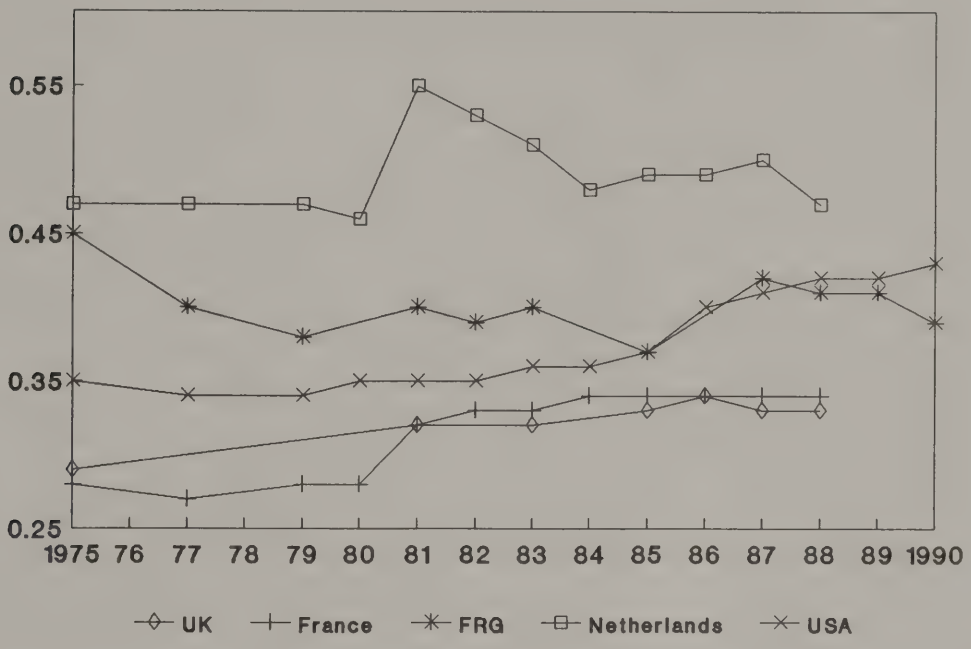
26. The research funding per head of university academic staff, both long and short term, involved in Science Base research increased in real (GDP deflator) terms by 19% for the period 1981/82 to 1988/89 (table 5.2). However, these apparently encouraging figures conceal the fact that the research spending of the greatly increased numbers of short term staff, who are primarily engaged in research rather than teaching and supervision, is likely to be very considerably higher than that of permanent staff.

27. The proportion of science and engineering graduates with first class degrees who subsequently pursue careers in research has decreased over the period. There has been a large rise in the proportion following careers in commerce (table 5.4).

3 International Comparisons

28. Comparative data, prepared by the Organisation for Economic Co-operation and Development (OECD), on research and development (R&D) expenditure in the higher education sector (HERD)[3], expressed as a percentage of GDP are shown in figure B.

Figure B - HERD as a percentage of GDP



Source: OECD

29. Among the major world economies the UK has one of the lowest HERD: GDP ratios for the period 1981/82 to 1988/89. Figure C indicates that the DES contribution to this ratio has declined significantly since 1981/82, and is projected to decline further[4].

30. The ABRC has also conducted a detailed survey of Government funding of the science bases in a number of competitor countries. The results shown in Figure D indicate a significant decline in the UK position since 1975.

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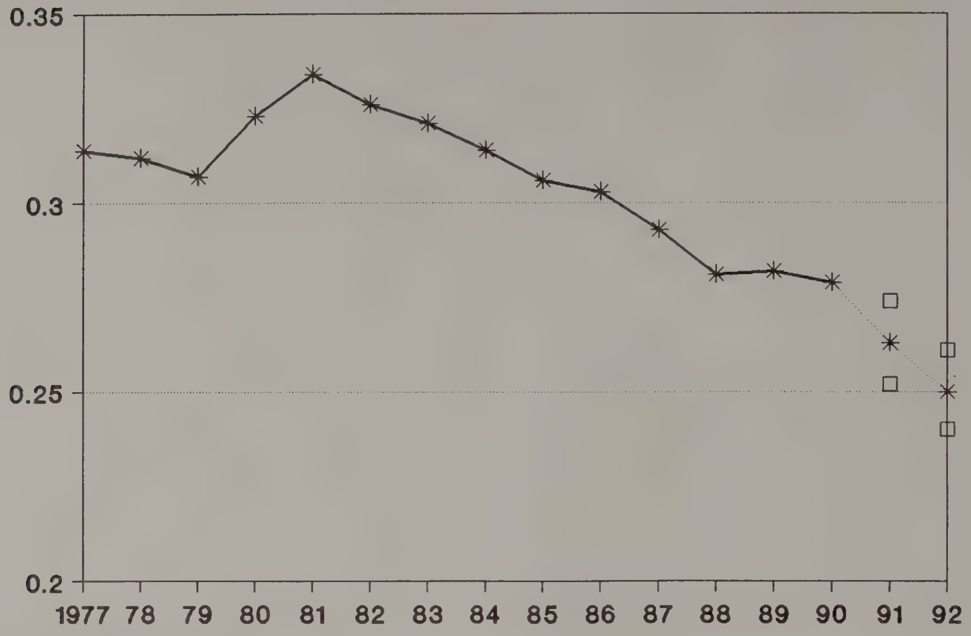
[3] The definition of HERD differs slightly from our definition of the Science Base and from that used in the ABRC studies mentioned above, but nevertheless includes funding of research in HEIs from Government, industry and non-profit making bodies. The ABRC study, which is confined to Government funded research, analysed further the activities of various HEIs and arrived at a different partition of teaching and research from that adopted by the OECD. This explains the numerical difference in Figures B and D. Figure C was drawn from a different data series which is tabulated in table 2.2.

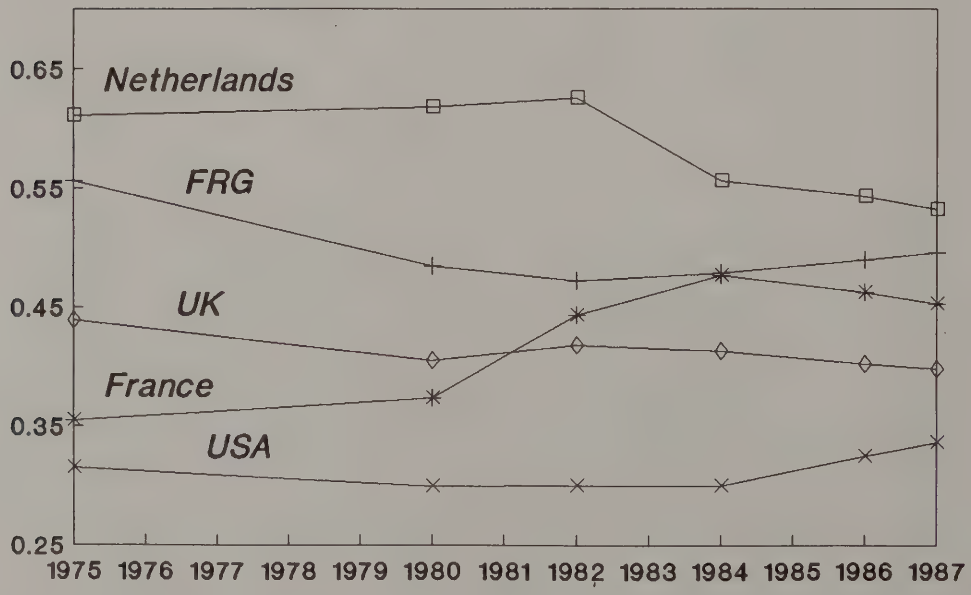
[4] As previously, the error bars show the effect of a 10% variation in the UFC forward estimates.

Figure C - UK Science Base Funding from DES sources as a proportion of GDP



Source: SEPSU Table 2.2

Figure D - Expenditure of various governments on academic and related research as a percentage of GDP

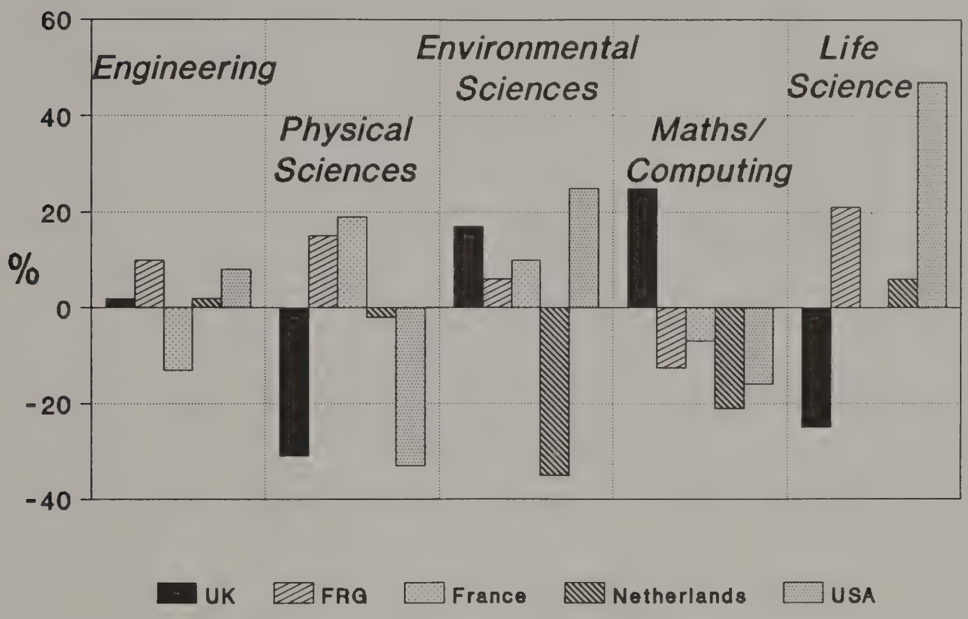


Source: ABRC\SPRU

31. Such statistics are open to a number of interpretations and should be treated with caution. Furthermore, a full analysis would require comparisons not only of inputs but also of the processes that are funded and the outputs they achieve. Nevertheless, the UK appears to devote a smaller share of its resources to academic science than do most of its leading competitors.

32. In a recent paper that draws on the ABRC survey data, Martin *et al* have attempted to make limited international comparisons of funding by discipline. These are based on averages for each of several subjects for the UK, the former West Germany, France and The Netherlands. Figure E indicates that Government funding per capita in the UK is average for engineering, above average in the fields of computing and mathematics and environmental sciences but significantly below average for the physical and life sciences.

Figure E - Deviations in UK funding from European average by field (1987 data)



Source: Martin et al

4 Discussion

33. Some of the main anxieties expressed by the scientific research community are now examined in the light of the findings of the SEPSU study. Others are considered further in Appendix 3.

The adequacy of funding

34. As indicated in Section 2, funding for the Science Base increased significantly in real terms in the eleven years from 1977/78 to 1988/89. But, despite these increases, budgets for Science Base research remain under pressure. We think there are three main reasons for this.

35. First, the costs of undertaking advanced research at the frontiers of knowledge using sophisticated equipment have risen faster than general inflation.

36. Second, there has been a rapid growth in scientific opportunities and hence in the volume of scientific research which HEIs and individual scientists have either tried to undertake or would wish to undertake.

37. Third, and perhaps most important of all, it has been assumed until now that the UGC/UFC funding would cover substantially all universities' indirect research costs. As a result, the Research Councils and charities have generally not been expected to pay the full costs of the research they sponsored; and Government departments have generally declined to do so, despite Government policy to the contrary. Industry has also been reluctant to pay full costs even of contracted research. As indicated in paragraph 24, the level of research support from these sources increased by 96% in real terms between 1980/81 and 1988/89. However, the element of UGC/UFC funding allocated on research related criteria has not matched this growth. In consequence, the proportion of universities' resources devoted to underpinning externally sponsored research has increased leaving less available for self-directed research endeavour.

The UGC/UFC contribution to research funding

38. Over the period covered by the study, the UGC/UFC funding of universities was in the form of a block grant which, in principle, each university could spend as it chose. The figures in table 2.4 are derived by assuming that, on average, some 38% of resources (ie block grant plus home student fees) was for research, a figure which is consistent with the results of a number of surveys. These surveys have a number of limitations, but they suggest that the overall percentage has not varied substantially during the last twenty years. It is nevertheless recognised that there are large variations in the percentage, as between subjects (and between universities). For example, UGC estimates, based on peer judgement, range from 50% in physics to 20% in dentistry.

39. Within the dual-funding system for research the purpose of the UGC/UFC block grant has been to fund the 'well-found laboratory'. More specifically it was intended to cover the following items needed to enable universities to create a firm foundation for Science Base research:

(a) the salaries of the academic staff who direct and lead the research and part of the salary costs of technical and other assistance;

(b) the recurrent costs of buildings in which the research is done (including their services and maintenance) and the associated library facilities;

(c) the cost of consumables, as well as much of the apparatus to be looked for in a well-found laboratory;

(d) the appropriate share of the costs of central administration of the university;

(e) many of the costs, other than maintenance, of research students; and

(f) "seed-corn" funding to support new research at an early stage of development.

40. Resources for such well-found laboratories are now severely constrained for the reasons indicated in paragraphs 35 and 36 and more particularly in paragraph 37. The material and service items in the list in paragraph 39, ie buildings, maintenance, consumables and apparatus have borne the brunt of the resulting financial pressure. Staff costs, on which there is greater reluctance (and it is more difficult) to effect savings, were protected. The exceptions to this were technical staff and, to some extent, secretarial staff, where the natural turnover is higher and savings can be made by not filling vacancies.

41. ACOST is particularly concerned about this weakening of the firm foundation for Science Base research which the UGC/UFC grant was intended to provide and the consequently reduced scope for universities to support seed-corn research at an exploratory stage, before it is sufficiently developed to attract grants. Regrettably, there is little information about these trends in research spending at the laboratory level.

42. Following a consultative paper issued by the DES in January 1990, the Government has started to modify the dual support boundary by transferring to the Research Councils responsibility for funding all the costs of the projects which they sponsor, except for the salaries of academic staff who contribute only part of their time to the project and also the costs of general premises.

43. As part of the preparation for this change, joint studies by the CVCP and ABRC estimated that, on average, universities have contributed from their other resources a further 24% of the value of grants towards the direct costs of Research Council projects, and a further 41% of direct staff costs towards the indirect costs of these projects.

44. In general, universities treat funding from charitable foundations in the same way as Research Council grants (as does the UFC in assessing the research element of general university funds). It is therefore likely that similar additional funding has been provided by universities for these grants.

45. The shift of the dual support boundary, together with better definitions of the responsibilities of the Research Councils and the UFC, will go some way towards clarifying the organisational ambiguities that have contributed to the funding difficulties discussed above. It will not provide a total solution, and in particular will not increase research resources.

46. Further to this, under the Further and Higher Education Act 1992, the Government has removed the "binary line" between universities and other HEIs, and the UFC and PCFC are to be succeeded by a Higher Education Funding Council for England, a Higher Education Funding Council for Wales and a Scottish Higher Education Funding Council. This will further increase competition among HEIs for research funds.

The proposed expansion of higher education

47. One other development with potential consequences for Science Base research is the proposed expansion of higher education which might, if not adequately funded, result in a reduction in the resources which HEIs devote to research. However, the Government has said that it will take account of student numbers in setting the level of future teaching funds. The shift from flat rate to differential tuition fees from Autumn 1991 will also help to ensure that teaching in the more expensive science subjects is properly funded.

Recovery of research costs

48. As noted above, universities have not recovered anything like the total of indirect costs they have incurred in undertaking research for industry, charities, and Government departments. The rate of recovery for these costs in 1988/89, as estimated by the UFC from the standard Universities' Statistical Record (USR) returns made by all universities, ranged from zero to 60% of direct costs, the median lying at about 14%. Although some universities are making strenuous efforts to recover their full costs, most are falling far short of what is necessary.

49. The UFC have estimated that every 1% shortfall in the recovery rate nationwide represents a loss of over £2m. This damaging development may account for the deeply felt perception amongst universities that their greatly improved success in attracting private sector research funding has gone hand in hand with their greater impoverishment.

50. Improvements in most recovery rates are being made. One important exception is in recovery rates for EC supported research, which are declining.

Flexibility of Research Council funding

51. As new areas of scientific study emerge, there is a continuing need to invest in new laboratories and facilities as well as in the pioneers and future exponents of this science. It is a long term investment and must be treated as such if the UK is to enjoy the benefits that will ensue. There are doubts that there is sufficient flexibility of funding within the Research Councils to allow both a rapid response to new developments and the maintenance of a diversity of long term programmes in key areas.

52. The House of Lords Select Committee on Science and Technology has drawn attention (3rd Report 1990-91) to the fact that short term spending cuts fall unduly heavily on new projects, new grants and studentships, because the longer term commitments of the Research Councils consume such a large proportion of their budgets.

53. International collaboration, for instance, offers many benefits to scientists, particularly those engaged in large-scale projects. However, the inviolate nature of commitments to international collaborative programmes (and the adverse effect of exchange rate fluctuation) can have, and has had, a direct effect on the funds available for other research grants.

54. The limited ability of the Research Councils to carry forward funds from one year to another was also criticised in the Select Committee's Report. It was felt that this could encourage the Research Councils to overcommit themselves financially in order to avoid a possible loss of funds at the end of the year. In its response (Cm 1609), the Government replied that the carry-forward arrangements for recurrent expenditure are the same as for other non-Government public bodies, and that payment in advance of need would contravene Treasury public accounting procedures.

55. There may, however, be a case for accruing notional reserves which the Research Councils could accumulate for major projects and which could be drawn down when required. Alternatively, an increase in the contingency provision held by the ABRC might serve a similar purpose.

56. Measures which would encourage long term planning within the Research Councils, and the means to implement the plans would bring a welcome degree of stability to academic science.

57. The Research Councils have to plan within the Government's announced expenditure plans, supporting their highest priority activities within the indicative spending allocations given them for future years. They also develop supplementary plans for lower priority activities that they would support if more funds were to be made available. These planning approaches are increasingly effective and might be developed further with explicit common assumptions

about future inflation, and greater clarity about the Government's spending plans. In parallel, some easing of the restrictions discussed above governing the transfer of Research Council funds from one year to another might enable more consistent allocation of funds to key areas.

58. The Research Councils' task would be eased if greater reliance could be placed on the 3-year forward planning figures for the Science Budget which are announced in each public expenditure round. The figures for years 2 and 3 have often under-estimated subsequent expenditure settlements, and have committed Research Councils to plan for unnecessarily large research cuts. This is both wasteful and demoralising for the scientific community. Realistic forward planning figures are vital if Research Council planning is to be carried out efficiently and effectively. We therefore welcome the fact that the forward planning figures for 1993/94 and 1994/95 announced in the 1991 Autumn Statement show a rising trend in real terms expenditure since this suggests that these planning figures are more realistic than they have sometimes been in the past.

Short term research assistants

59. The total number of full time academic staff funded from all sources in 1989/90 was 22% higher than in 1977/78 (table 4.2). However, the number of full-time staff funded from UGC/UFC funds (ie essentially long term staff) fell by 5% during the same period. The actual loss since 1980/81 is some 3000 posts.

60. Over the same period, there has been a very substantial increase in short term appointments funded by other sources such as Research Councils, charities and industry. These have increased by 138% across all subjects. In science, short term posts have increased from 22 to 42% of all staff. For engineering, the figures are similar. Short term staff are invariably young and 86% of them are carrying out full-time research. There has been an increasing tendency, particularly in engineering, for Doctor of Philosophy (PhD) students to take salaried research assistant posts in preference to less remunerative studentships. This trend, coupled with the increase in external funding of research, has been an important factor in the growth of academic staff on short term appointments.

61. The rapid expansion in the number of researchers on short term contracts is one of the most striking trends over the last ten years. Many of the researchers go from one short term contract to another, and there is increasing concern over the lack of credible career patterns.

Changing research patterns

62. Changing research patterns can have implications for funding, the organisation of HEIs, and the careers of researchers.

63. For example, the trend towards equipment-centred groupings can lead to the equipment becoming a heavy burden on departmental budgets, if the number of UFC-funded staff using the equipment starts to decline and less is contributed towards its maintenance.

64. Large scale shifts towards the problem-oriented research often supported by charities and industry also necessitate more interaction between scientific disciplines. This may entail significant re-organisation in the HEIs committed to such work.

65. In addition, as priorities for research change, some groups or individuals may need to change their field of endeavour. At the personal level this requires recognition that individual researchers are of more value for their innate and cultivated skills of scholarship and research discipline than for the contribution that they may make to an obsolescent field of study. Those that do not respond to the new needs will experience increasing difficulties and frustration, ascribing their problems to inadequate resources rather than a failure to adapt.

5 Conclusions and Recommendations

Introduction

66. We have examined trends in the funding, staffing and expenditure of the Science Base over recent years. It has been difficult to obtain reliable data in some areas, particularly those relating to actual expenditure on research. For this reason, our analysis (and discussion generally) is focused on funding, rather than expenditure.

67. A healthy, independent, and diverse Science Base is essential to the long term economic and social welfare of the nation. As well as developing and exploring new concepts, it undertakes the training of the skilled scientists and engineers of the future, and provides a channel for the import of new ideas. Because of the spontaneous nature of scientific discovery, HEIs should be largely free to determine their own strategies for managing the funds at their disposal, taking into account their individual strengths and weaknesses and embodying their particular concerns for academic science. On the other hand, the Government needs to identify and protect the national interest by stimulating, when necessary, further activity in key areas. This may warrant action by departments in the form, for example, of the establishment of new LINK programmes. There is also a natural consequence that growth in some areas may necessitate decline in others.

68. Over the last ten years, HEIs have endeavoured to adapt to their changed circumstances by adopting new working patterns, cutting costs and diversifying their sources of income. Over the same period, total funding for the Science Base has increased significantly in real terms. But despite these increases, budgets for Science Base research remain under pressure. One reason is that the costs of undertaking advanced research at the frontiers of knowledge have risen faster than general inflation. There has also been a rapid growth in scientific opportunities and hence in the volume of research which HEIs have either tried to undertake or would wish to undertake. These problems have been exacerbated by the inadequate recovery of costs incurred in the conduct of growing areas of sponsored research.

69. We believe that the Science Base has, for a number of years, found itself undertaking too much research for the available funding. It is essential that action be taken to redress this imbalance between funding and workload, and that future academic research is conducted on a sound financial basis. This will require either a considerable reduction in workload, through, for example, increased priority setting, greater selectivity and increased international collaboration, or the provision of extra funding. In practice, elements of both will be necessary. We therefore welcome the fact that the Funding Councils are already moving in the direction of increased selectivity in Science Base funding.

Funding provided by industry, Government Departments and charities

70. In view of the growing role of external, especially industrial, support for their research programmes, several HEIs have appointed specialist staff to manage this, now large, additional business. Such staff may be responsible for the negotiation of contracts, for industrial links, for liaison with major funding bodies such as the EC and even for the management, though not the direction, of the larger research groups. Such staff have a major part to play in recovering indirect costs.

71. Sponsors (including Government departments) must expect increasingly to pay a greater proportion of the costs of the research performed on their behalf by HEIs. Sometimes, part of the costs may be met in kind, by patronage or by allowing other research lines to be pursued. Nevertheless the full significance of the cost implications of these factors should be identified by HEIs for the contracts they enter into.

72. As academic researchers gain more contact with their counterparts in industry, they develop common interests. Industry may then wish also to contribute to research which the HEIs are already undertaking or planning to undertake. In such cases, HEIs might wish to set their own policy on charges. Again, the real costs should be identified and the consequences of only partial recovery, for the rest of the academic community, should be made clear. To aid this process, HEIs should establish transparent procedures for internal resource distribution.

73. In order to support a coherent system that funds the true costs of research, **we recommend** that, with the exception of some research of mutual interest which universities are able partially to support from their own resources, Government departments, industry and charities should generally pay the full costs of the research they sponsor.

74. Further, **we recommend** that universities should disclose information on all research which they take on at less than full cost.

75. We welcome the new arrangements whereby the Research Councils will also pay the full costs of the research they fund in HEIs, apart from academic salaries and general premises costs.

76. The universities have been given some encouragement to interact with industry by the UFC funding formula which includes an element related to the level of contract research. However, this element has, until recently, been small. We therefore welcome the UFC's announcement, in February 1992, that the element is to be increased. **We recommend** that the HEFCs should continue to keep under review the scope for encouraging greater university-industry interactions by further increases in the size of the research funding element which is related to industrially funded research. Such a larger element should not be seen as a subsidy for industry which should, as discussed above, be expected generally to pay full costs. On the contrary, it should be regarded simply as providing an incentive for universities to work more closely with industry. It is also an important contribution to providing key university groups with the resources necessary to support successful bids for undertaking sponsored research.

77. Even with such enhanced incentives for universities to undertake research for industry, it is possible that the volume of research in universities which is funded by industry will decline when industry is expected to pay full costs. But we do not see this as an argument against full costs being charged. A strong level of university-industry interaction is highly desirable. But such interactions are most likely to be profitable when the university involved has particular skills, knowledge, expertise or facilities which can add value to industry's own research efforts. Industry should not be using universities simply as a source of cheap research services.

78. As for all other public expenditure, HEIs should become more accountable for their use of public funds. Significant advances in their procedures for financial management have been made over the last ten years. The recommendations of the Jarratt report are slowly being implemented and progress towards achieving increased accountability has been made. But further improvements are needed to enable shortcomings in charging policies to be recognised and corrected. In particular, the costing of projects is a relatively undeveloped activity in the UK and this has contributed to the widespread practice of charging research sponsors on a marginal basis.

79. **We recommend** that the HEFCs urgently promote the introduction of standard bases for cost accounting that will enable more informed decision making in relation to the costs of research. Wherever possible the full costs of research activities should be identified. In the short term, this might involve the use of average figures in the assessment of overhead costs, but HEIs should go as far as possible towards identifying actual costs without creating undue administrative burdens. The important work done by the CVCP in this area should be fully considered. Compatibility with systems used by the Research Councils' Institutes and Laboratories is also desirable, so that detailed comparisons of efficiency can be made.

The differentiation between teaching and research costs

80. An unintended consequence of developments over the decade has been the increased constraints on universities' freedom to support research without grants from other agencies. The dual support system and the vagueness of accounting arrangements for research have obscured many of the problems of underfunding. The extent of cross-subsidisation between teaching and research is not known. If these two vital activities are to receive the support they deserve, then the true costs of what is done must be identified. We therefore welcome the efforts made by the UFC to differentiate between teaching and research elements of the UFC grant.

Future Government funding

81. The efforts which the Funding Councils are making to increase selectivity in Science Base funding and the proposals set out above, which are aimed at developing a coherent system that funds the true cost of research, will go a long way towards bringing Science Base resources and the Science Base workload back into balance. But we believe that some extra funding will also be needed to bring the Science Base back to a healthy state as rapidly as possible. **We recommend** that the Government should build on the 1992/93 public expenditure settlement by providing additional funding for the Science Base in future years, above the increase necessary to keep pace with inflation. Further arguments in support of such an increase are given in Appendix 4.

82. **We recommend** that a large proportion of these extra funds should be allocated by the Research Councils but that a significant fraction should be used to enhance the research element of the HEFCs' grants to enable universities to rebuild a firm foundation for Science Base research and to continue their restructuring process.

83. **We recommend** that the HEFCs should allocate these additional funds on the basis of the quality of the research undertaken. Allocation thereafter would be a matter for individual HEIs. However, we would urge HEIs similarly to direct the funds towards departments, recognised research groups and individuals on the basis of research quality.

84. It is important that the extra funds are not used to employ extra researchers as this would lead to an even larger number of insufficiently supported staff, thus exacerbating the imbalance between funding and workload. **We recommend** that the HEIs and the HEFCs should take steps to ensure that the extra funds are used to improve the support given to existing staff and facilities.

The career structure for academic researchers

85. There has been a large increase in the number of short term researchers employed in the Science Base over the past decade. The rise in more staff intensive engineering grants explains part of the short term increase. It is also clear that many short term researchers have been recruited to carry out programmes contracted from industry and the charities.

86. The appointment of short term research assistants to undertake a large fraction of the research being conducted by HEIs offers some advantages. It retains within the HEIs a large pool of highly intelligent, skilled people, the size of which can be readily adjusted to meet demand. The more senior of these research assistants have often assumed responsibilities similar to those borne by full-time academic staff. Research in HEIs also provides valuable training for those who intend to seek a career in industry; the number of career researchers, working on successive contracts should not, however, be permitted to prejudice the needs of industry and commerce for a continuing supply of trained recruits.

87. Unfortunately, the build-up of this cohort of academic staff on temporary appointments has coincided with reduced opportunities to appoint permanent staff. The result has been increased uncertainty for the prospects of young scientists who might otherwise have

confidently contemplated academic careers. This represents a difficult problem which HEIs must address.

88. In the light of these points, we believe that the present provisions for the salaries of young research staff should be reconsidered, and that greater thought should be given as to whether research assistants not destined for academic posts should be re-appointed. **We recommend** that HEIs should acknowledge full responsibility for tackling these points and should promote a better career structure for academic researchers in science and technology. Greater salary differentials may be necessary to attract and retain outstanding scientists. Further thought needs to be given to career options which will enable promising young scientists to establish themselves in fields which will offer them the greatest scientific opportunities and, where appropriate, provide the necessary experience for a subsequent move to industry.

Post graduate awards

89. The discrepancy between the levels of post graduate awards and commercial salaries has become too great and there are concerns that it may be affecting the recruitment of aspiring scientists in some disciplines. **We recommend** that this is kept under continuing review by the Research Councils.

Long term planning

90. Research is a long term endeavour, and as universities take greater responsibility for their own futures, they will need to plan their activities on a longer timescale than hitherto. The Research Councils, also, need flexible forward plans in order to meet changes in priorities and financial commitments that are sometimes not within their control. **We recommend** that the Government should consider what measures can be taken to enable universities and the Research Councils to plan more effectively for the longer term. This might include, for instance, increasing the reserve (or creating a notional reserve) that Research Councils can carry forward to the following year, and encouraging their longer term plans to be developed further with explicit common assumptions about future inflation, and greater clarity about the constraints of the Government's spending plans. The Government should also continue to try to improve the accuracy of forward planning figures for the Science Budget.

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GLOSSARY

ABRC = Advisory Board for the Research Councils
ACARD = Advisory Council for Applied Research and Development
ACME = Application of Computers to Manufacturing Engineering
ACOST = Advisory Council on Science and Technology
AFRC = Agricultural and Food Research Council
CERN = Conseil European pour la Recherche Nucleaire (European Organisation for Nuclear Research)
CIHE = Council for Industry and Higher Education
CNAA = Council for National Academic Awards
CVCP = Committee of Vice Chancellors and Principals
DEM = Department of Employment
DEN = Department of Energy
DES = Department of Education and Science
DFE = Department for Education
DHSS = Department of Health and Social Security
DOE = Department of Environment
DTI = Department of Trade and Industry
E&T = Engineering and Technology
EC = European Community
EMBL = European Molecular Biology Laboratory
ESA = European Space Agency
ESRC = Economic and Social Research Council
FTE = Full Time Equivalent
GDP = Gross Domestic Product
GLP = Good Laboratory Practice
HEFC = Higher Education Funding Council
HEI = Higher Education Institution
HSE = Health and Safety Executive
ILL = Institut Laue-Langevin, Grenoble
MA = Master of Arts
MAFF = Ministry of Agriculture, Fisheries and Food
MOD = Ministry of Defence
MPhil = Master of Philosophy
MRC = Medical Research Council
MSc = Master of Science
NATO = North Atlantic Treaty Organisation
NCC = Nature Conservancy Council

NERC = Natural Environment Research Council

NI D o Econ Dev = Northern Ireland Department of Economic Development

ODA = Overseas Development Agency

OECD = Organisation for Economic Co-operation and Development

OST = Office of Science and Technology

PCFC = Polytechnics and Colleges Funding Council

PGA = Parliamentary Grant-in-Aid

PGCE = Postgraduate Certificate in Education

PhD = Doctor of Philosophy

PREST = Policy Research in Engineering, Science and Technology

R&D = Research and Development

RAL = Rutherford Appleton Laboratory

RGO = Royal Greenwich Observatory

ROE = Royal Observatory, Edinburgh

SEPSU = Science and Engineering Policy Studies Unit

SERC = Science and Engineering Research Council

UFC = Universities Funding Council

UGC = University Grants Committee

UPPI = Universities Pay and Prices Indicator

USR = Universities Statistical Record

APPENDIX 1

SCIENCE BASE STUDY GROUP

MEMBERSHIP

Sir Graham Hills FRSE FRSC **(Chairman)**
Former Principal and Vice-Chancellor
University of Strathclyde

Professor Thomas Blundell FRS **(Until January 1991)**
Department of Crystallography
Birkbeck College
University of London

Lord Porter OM PPRS
Chairman, Centre for Photomolecular Sciences
Imperial College of Science, Technology and Medicine

Professor Sir David Phillips KBE FRS
Chairman
Advisory Board for the Research Councils

Professor Christopher Llewellyn Smith FRS **(from May 1990)**
Chairman of Physics
University of Oxford

Sir Peter Swinnerton-Dyer FRS
Former Chief Executive
Universities Funding Council

Dr Peter Doyle **(from May 1990)**
Director of Research and Technology
ICI plc

Secretariat
Dr John Leather
Dr David Lumley
Dr David van Rest (until May 1990)

TERMS OF REFERENCE

To examine the provisions made by the DES for supporting science and technology skills through the Science Base, taking particular account of changes over the last ten years in:

- the distribution of the budget;
- the relative costs of equipment, and ways in which investment considerations have evolved;
- the adaptations made by different groups and disciplines to changing circumstances;
- consideration given to adequate costing and charging policies;
- the scoring of unfunded alpha-quality research proposals as a measure of funding needs;
- the significance of the increasing use of research assistants on short-term contracts.

To make broad comparisons with experience overseas. To assess whether the availability of data and its categorisation are adequate for the purposes of policy determinations. To consider what are the constraints on increased activity in the Science Base. To review the changes in spending by industry, charities and other Government departments on research in Higher Education Institutions over the last ten years. To draw conclusions, identify outstanding policy questions and make recommendations.

APPENDIX 2

THE UK SCIENCE BASE RECENT STATISTICAL TRENDS

A report by the Science and Engineering Policy Studies Unit.

THE UK SCIENCE BASE

RECENT STATISTICAL TRENDS

P.M.D. Collins, H.J. Moxham, M.J. Ringe, T.A. Shoults

A report for the ACOST Science Base Study Group

SCIENCE AND ENGINEERING POLICY STUDIES UNIT

The Royal Society

The Fellowship of Engineering

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I Introduction

Objectives

This report presents statistical data on the main characteristics of the UK Science Base. The 'Science Base' is a term that in practice covers not more than 30% of total Government-funded R & D, or rather less than 15% of total UK R & D activity; our data therefore deal with only one part of R & D activity in the UK. This report is intended to document, statistically, some of the major structural developments in the Science Base over the last ten years.

Definitions

For the purposes of this report, 'Science Base' is defined as:

- all research funded and/or performed by the five research councils, and
- all other research performed by higher education institutions (HEIs).

The usual definition of 'Science Base', restricted to research funded by the Department of Education and Science (DES) and performed by the research councils or HEIs, has thus been extended here to include commissions and contracts from non-DES sources.

'Science Base' should strictly cover all higher education institutions. However, we have omitted polytechnics and colleges from this report, mainly because the relevant statistical data are not well enough established for trend analysis. A report published by the Polytechnics and Colleges Funding Council in September 1990 indicates that, across all disciplines, research expenditure in PCFC institutions grew from £56M in 1986/87 to £80M in 1988/89 (cash terms), or from £72M to £91M in 1990 (GDP deflator) pounds. Of the £80M, £60M was spent in mathematics, science and technology disciplines.

Wherever possible, we have presented data for all years since 1977/78. Years are financial, academic or calendar, according to context. Both clinical and non-clinical research are included in the data where appropriate, though in practice very little research in university engineering or science departments is classified as 'clinical'.

Research council accounting procedures have not been consistent in all categories over the whole of the time span, so it has not always been possible to show continuous trends in specific items of expenditure. In particular, over the last few years, the research councils have moved towards cost-centred accounting. Coupled with this is an on-going effort to standardize accounting procedures between research councils. There are still differences between research councils as to which items are included under certain expenditure heads, so it is not always valid to make direct comparisons of specific items of expenditure across the five research councils.

We have not attempted to measure trends in the distribution of the Science Base effort between basic, strategic and applied research. Funding is not defined within these categories in the statistics available to us; indeed, it is not clear that it could usefully be so defined.

So far as possible, data are accurate as at September 1990. Since that date, however, estimates of inflation have been revised upwards, from 4.75% to 6.0% for 1991/92 and from 3.5% to 4.75% for 1992/93. This means that figures given in 'real terms' for income or expenditure in these years are overstated by 1.25%.

Acknowledgements

We gratefully acknowledge the assistance of colleagues in the research councils, the Universities Funding Council and the Universities Statistical Record in the provision of data.

II Science Base Income

(i) Interpretation of financial trends

GDP deflator and UPPI

To interpret trends in financial data, one must have a means of converting figures to a common base (e.g. 1990 pounds) so as to eliminate the effects of inflation from the observed trends. The Treasury enforces the convention that, in the context of public expenditure, this is done by means of the Gross Domestic Product (GDP) deflator. However, it is far from obvious that the GDP deflator, designed for the national economy as a whole, can give a valid account of a specialized activity such as scientific research. We have therefore also used, mainly for its convenience, the Universities Pay and Prices Index (UPPI) (formerly the 'Tress Brown Index'); this covers other activities in addition to research, and it is based on actual expenditure (thus including incremental salary drift), but we have included it in some of the financial tables in order to emphasize how critically 'real cost' trends depend on the rules laid down for converting cash figures.

The UPPI deflator is derived from measurements of expenditure, and does not include any projections of future expenditure. The GDP deflator does include future projections, based on Government forecasts of (or targets for) inflation in future years. These forecasts, however, almost certainly underestimate what will actually happen: for example, in March 1990 the official GDP estimate for inflation in 1990/91 was 6.5%, but by September 1990, the annual rate of inflation as measured by the Retail Price Index was running at 10.9%. 'Real terms' figures for income or expenditure given in this report for future years are therefore likely to be overstated. [Since this report was written, official forecasts for inflation have been revised upwards. See p.37 above.]

Salary indices

Table 2.1 compares the salary of the 'typical' university lecturer with various financial indices. The difference between UPPI and the GDP deflator appears to arise from salary increases, incremental drift related to an ageing population of university staff (see figure 4.2) and trends in non-salary items such as the costs of equipment used in universities.

We would not argue that any one of these indices is ideally suited to the task of measuring trends in research costs. We would, however, point to the need to establish an agreed index of research costs as a basis for analysis of real trends.

Science Base as % of GDP

Another way of looking at 'real' costs is to compare, in cash terms, expenditure on the Science Base each year with the GDP that year. This indicates what proportion of national wealth is invested in the Science Base. As table 2.2 shows, that proportion increased between 1979/80 and 1981/82, reaching 0.334%; it has declined almost continuously ever since, and current planning figures imply that it will reach 0.250% in 1992/93.

(ii) Trends in Science Base income

Science Base

Table 2.3 shows trends in Science Base income from all sources, and table 2.4 shows trends in Science Base income just from DES sources.

The total income of the Science Base from all sources increased in real terms between 1977/78 and 1988/89, by 32% according to the GDP deflator or by 13% as measured by UPPI. This increase was stimulated by growth in income from non-DES sources, up from 19.7% of the total in 1977/78 to 29.4% of the total in 1988/89, with most of this growth occurring since 1981/82.

The total income of the Science Base from DES sources rose by 19% in 'real' (GDP deflator) terms between 1977/78 and 1990/91, but is planned to fall by 6% by 1992/93. UPPI, however, gives only a 3% rise between 1977/78 and 1990/91.

These income figures do not include research carried out in polytechnics and funded by sources other than the research councils. Such research has expanded significantly in recent years and in 1988/89 stood at 4% of total Science Base income from all sources.

Science Budget

The Science Budget (i.e. the money distributed by DES on the advice of the ABRC) increased by 33% in 'real' (GDP deflator) terms between 1977/78 and 1990/91. It is set to fall by 4% between 1990/91 and 1992/93; this figure, moreover, is based on predictions for inflation (4.75% in 1991/92 and 3.5% in 1992/93) that may prove to be too low, so at current planning figures the actual 'real' terms decrease may be greater than 4%. If the UPPI is used instead of the GDP deflator as a measure of 'real terms', there is 16% rather than 33% growth between 1977/78 and 1990/91.

Within this overall budget, individual research councils have been affected differently by changes in the distribution of funds. ESRC income from DES declined in 'real' (GDP deflator) terms by 4% between 1977/78 and 1990/91; the other four councils have all had 'real' terms increases, of varying amounts, since 1977/78.

Universities

The data on funds disbursed by the UGC/UFC in support of university research must be regarded as inherently very approximate, and figures have been rounded to the nearest £2.5M. But whatever their accuracy in absolute terms, UGC/UFC figures for research spend are calculated on a consistent basis from year to year and thus give reliable trends. The GDP deflator shows UGC/UFC funding for science and engineering research as rising in 'real' terms by 4% from 1977/78 to 1990/91 but as planned to fall by 9% between 1990/91 and 1992/93 (exclusive of any transfer of funds to the research councils). The UPPI shows UGC support of university research not as rising, but as falling by 10% between 1977/78 and 1990/91.

(iii) Sources of income

Research Councils

Trends in each research council's sources of income are shown in table 2.5. There are substantial differences between the research councils in the proportion of their total income derived from Parliamentary Grant-in-Aid (PGA) via the DES. Within individual research councils, changes over the ten year period have been relatively modest.

ESRC, SERC and MRC receive almost all their funds from the PGA. The proportion of ESRC's total income derived from the DES has remained constant since 1977/78 at over 95%. SERC received 97.7% in 1977/78; a steady small increase in funding from outside sources decreased this proportion to 92.6% by 1988/89. With the back transfer of Rothschild money from the DHSS in 1981/82, MRC's contribution from the DES rose to 95.3%. Since then there has been a slight reduction to 91.1%.

NERC and AFRC each receive a substantial proportion of funding from sources other than the DES PGA. NERC's allocation from the DES has risen since 1977/78 from around 60% to over 70%, while AFRC's has oscillated in the 45% to 55% range. The proportion of AFRC income derived from MAFF declined from a peak of 50.1% in 1983/84 to 40.6% in 1988/89.

Table 2.6 gives further details of research councils' income from Government sources other than the DES and from the European Community. In 1988/89 income from the EC, as a proportion of total non-DES Government plus EC income. stood at 19% for AFRC, 12% for MRC and 6% for NERC.

Universities

Table 2.7 charts the rapid increase in income secured by universities from research grants and contracts, i.e. from non-UGC sources. Research grants and contracts constituted 26% of total university income for research in all disciplines in 1977/78, and 44% in 1988/89. In 'real' (GDP deflator) terms, income from these sources grew at an average rate of 9.0% p.a. between 1977/78 and 1988/89. The rate of increase has been slowest for income from research councils and Government departments, and most rapid for income from industry and charities. The distribution of non-UGC funding in 1988/89 was: 34% from research councils, 21% from charities, 15% from industry, 16% from Government and the remaining 14% from other sources.

Departments of science, agriculture and engineering accounted for 55% of total expenditure from research grants and contracts in 1981/82, and 53% in 1988/89. Medical and related departments accounted for 35% of total research grants and contracts in 1988/89, and administrative, business and social studies accounted for 7%.

The data in table 2.7 cover all disciplines. A similar breakdown of income by source for science and engineering only is not readily available.

During the period 1981/82 to 1988/89, the annual growth in non-UGC research income for departments of science, agriculture and engineering averaged 9.0% in 'real' (GDP deflator) terms. For all disciplines combined, it averaged 10.1%.

In table 2.8, income from research grants and contracts per FTE member of UGC-funded academic staff is shown for three cost centres. The data illustrate the generally rapid growth of such income.

NB. Tables 2.1 to 2.8 give income received. The data may be different from expenditure data given in the next section.

III Distribution of Science Base Expenditure

(i) Distribution of research council expenditure by broad disciplinary area

The more closely disciplines are defined, the more difficult it becomes to allocate expenditure accurately among them. Therefore in table 3.1 we have analysed expenditure only under the broadest of headings, using the main categories employed by each research council. ESRC data are not amenable to this approach and have been omitted from this table.

Trends to note include the expansion of the SERC Engineering Board at the expense of the Nuclear Physics and Astronomy, Space & Radio Boards; the decline in NERC Solid Earth research and the growth in Terrestrial Environment research; and the expansion of Food Science and Technology in AFRC.

(ii) Postgraduate training

Expenditure by the research councils on postgraduate training is analysed in table 3.2. Postgraduate training accounts for about 12% of total research council expenditure and has remained at about that level since 1977/78. SERC accounted for 60% of the total research council expenditure on postgraduate training in 1980/81 and 71% in 1988/89. Each research council allocates a different proportion of its own expenditure to postgraduate training. The AFRC allocates less than 1%, NERC expenditure has remained constant at about 6%, while the MRC has slightly reduced its proportion from 6.3% to 4.3%. Postgraduate training accounted for half of the total expenditure of the ESRC in 1977, but has since been trimmed to less than a third.

(iii) Distribution of research council expenditure between HEIs and own establishments

Support for HEIs

There is considerable difference between the research councils in how they divide expenditure between HEIs and their own establishments, and in the nature of their HEI support (table 3.3). In addition to their expenditure on HEI research grants, postgraduate training and research contracts, the research councils also provide considerable support to universities through Research Units, closely integrated with universities, often with both research council funded and UFC funded staff, and through facilities made available for university use.

Numbers of full-time academic staff in universities in Great Britain who are wholly funded by the research councils are given below; the data are taken from USR annual reports, volume III. For comparison with numbers of research council staff, see table 4.5.

Numbers of full-time academic staff in GB universities wholly funded by research councils

University staff funded by:	1986/87	1987/88	1988/89
AFRC	318	284	328
ESRC	386	332	385
MRC	1,229	1,231	1,305
NERC	261	275	288
SERC	3,582	3,535	3,427
Total	5,776	5,657	5,733

AFRC and NERC devote the bulk of their expenditure to their own establishments, though the proportion allocated to HEIs has risen since 1977/78. By contrast, MRC and SERC allocate more of their budget to HEI support than to their own establishments. MRC's funding of research units has continued at approximately double the allocation to its own establishments, and at a level similar to that for HEI support via research grants, postgraduate training awards and research contracts.

ESRC does not have establishments similar to the other research councils, and, apart from some central expenses, all its funding has been allocated to HEI support, with a proportion going to Research Units until 1984/85.

Facilities
Both SERC and NERC provide facilities that are used by universities and other HEIs. SERC's own establishments house equipment used predominantly by universities; examples are shown below.

SERC facilities:

	1984/85	1985/86	1986/87	1987/88
Nuclear structure facility				
% own time	10.8	17.6	16.8	13.9
% HEI time	80.9	72.9	67.4	67.5
% other UK	0.0	0.0	0.0	0.0
% overseas	8.3	9.5	15.8	18.6
Central laser facility				
% HEI time	96.0	94.1	95.1	94.1
Synchrotron facility				
% HEI time	89.2	86.0	88.6	79.3

Percentage time allocation to universities of NERC's Research Vessel Services has fluctuated between 20% and 45% over the period 1979/80 to 1987/88. Figures are given below.

NERC Research Vessel Services

	79/80	80/81	81/82	82/83	83/84
% own time	61.7	62.3	65.9	56.9	70.7
% HEI time	38.3	37.7	34.1	43.1	29.3
% overseas	–	–	–	–	–
	84/85	85/86	86/87	87/88	
% own time	80.3	55.9	65.1	53.1	
% HEI time	19.7	44.1	34.9	39.7	
% overseas	–	–	–	7.2	

(iv) Distribution of SERC expenditure by type of activity

Engineering Board
Table 3.4 analyses the expenditure of SERC Engineering Board. The major item is research grants, which have increased in 'real' (GDP) terms nearly three-fold since 1977/78 and now account for about 70% of the Board's net expenditure. Postgraduate awards account for most of the rest. The reduction of net expenditure on establishments is due mainly to increased receipts from the Information Technology Directorate and the Teaching Company Scheme. The largest shares of research grant expenditure are taken by information engineering, including ACME, (40%) and engineering processes (15%).

Science Board

A similar analysis of Science Board expenditure is given in table 3.5. Research grants now take the largest share, 36% of the total, with postgraduate awards at 26% and establishments (RAL and Daresbury) at 27%; these proportions have fluctuated somewhat since 1977/78. Of total research grant expenditure, the proportion going to biology (excluding biotechnology) has declined from a maximum of 35% in 1981/82 to 25% in 1988/89; the proportion going to chemistry has declined from a maximum of 43% in 1979/80 to 23% in 1988/89; and the proportion going to mathematics has grown from 3% in 1979/80 to 7% in 1988/89.

(v) International subscriptions

Subscriptions to international organizations have accounted for between 18% and 30% of SERC's budget, the most costly subscriptions being those to CERN, ESA and ILL. MRC also subscribes to international organizations, the costs oscillating at around 2% of its budget. Figures are shown in table 3.6. For each research council the amount spent in 'real' terms and as a proportion of total expenditure declined towards 1981/82 and has since risen to near the 1977/78 level. Trends in currency exchange rates will have contributed to the fluctuation in subscription costs.

(vi) University expenditure on salaries

Total expenditure

Table 3.7 analyses university expenditure on salaries from general income (i.e. from income available for general purposes, excluding research grants and contracts and other sources of specific income). Table 3.8 provides similar information in respect of the three disciplines covered in part II of this report.

Salaries and wages account for 64% – 70% of total recurrent expenditure from general income. The proportion has risen fairly steadily since 1982/83, but has now levelled off. Other things being equal, this implies a growing pressure on the consumables budget. In 'real' (GDP deflator) terms, total expenditure on salaries has increased by about 4% since 1980/81.

For comparison, in eight AFRC institutes salaries and wages account for 66% of recurrent budget for 1989/90.

Academic salaries

Much the largest single element in total salaries expenditure is for academic staff, who now account for 57% of the total expenditure. Academic related, technical and secretarial & clerical staff each account for 10% – 14% of the total. The main trends since 1980/81 are a 'real' (GDP deflator) terms increase in salaries expenditure on academic related staff of 23%, and a decrease of expenditure on technical staff of 13%.

From table 3.8 it is apparent that science and technology cost centres devote a smaller proportion of their general income to salaries of academic and academic related staff than the average for all cost centres. Science and technology cost centres budget for more technicians than other cost centres: they also spend more on non-pay items such as equipment and consumables. These latter items are most significant in biological sciences/biochemistry and least (out of the three disciplines shown) in mechanical engineering. In all three disciplines, there has in recent years been an upward trend in the proportion of general expenditure going on academic and academic related salaries.

Trends in the salary paid to the 39 year old lecturer at the age-related point on his scale are given in table 2.1, discussed earlier in the context of inflation indices. The table shows academic salaries to have grown slightly faster than the cost of living since 1978/79.

Technician salaries
The declining 'real' expenditure on technicians' salaries has been mentioned already. Table 3.9 shows this in another way, by comparing expenditure on technicians' salaries with expenditure on academic and academic related salaries: the former have declined as a proportion of the latter from 20.4% in 1980/81 to 16.3% in 1988/89. Table 3.10 shows expenditure on support staff per FTE academic paid from general funds. For 1984/85 to 1986/87, 'support staff' means technical, clerical and secretarial staff, and expenditure per FTE academic has been fairly constant; the apparent rise in expenditure in 1987/88 is due to a broadening of the definition of 'support staff' to include certain staff on academic related scales.

(vii) Royal Society research grants scheme

In response to concern about the decreasing availability of relatively small grants for scientific research the Royal Society in 1989 launched a scheme to provide grants of up to £10 000 for consumables and equipment. The total sum available in the first year was £1.925M, which was distributed in two rounds. In the first round, there were 564 applications totalling £4.6M. 242 were graded alpha: of these 179 grants totalling £1.34M (30% of the sum applied for) were awarded, and the remaining 63 were carried forward for reconsideration in the second round.

The average value of grants applied for was £8125. The average value of grants offered was £7525, with the top ten percentile averaging £9782 and the bottom ten percentile averaging £2878. There was little difference between disciplines in the average value of grants. The size distribution of grants is shown in figure 3.1.

IV Manpower Aspects

(i) Introduction

This section deals with production by the Science Base of skilled researchers and with the demands of the Science Base for that same resource. Some of the tables address specific aspects of careers in academic research.

The data in this section cover, as appropriate, all UK universities (many published statistics cover Great Britain only) and clinical and non-clinical staff combined. In the various disciplines detailed separately (engineering & technology, biological science etc), virtually all staff are classified as non-clinical. Many of the tables present separate analyses according to how academic staff are funded: those paid out of general university funds hold long-term posts, while the others hold short-term posts of at most five years.

TECHNICAL NOTE
With effect from 1984/85, the Universities Statistical Record (USR) changed its analysis of disciplines from 76 subject categories arranged in 9 subject groups, to 39 cost centres. Subject categories do not always fit neatly into single cost centres. There is therefore an unavoidable discontinuity in our data, though at aggregate level (e.g. engineering & technology; biological, physical & mathematical science) the discontinuity is not serious.

A further discontinuity arose in 1984/85 from the merger of the New University of Ulster (Coleraine) with Ulster Polytechnic to form the University of Ulster; this added 500 full-time and 130 part-time academic staff to the statistics of UK universities.

Details of how disciplines are defined are given in the notes to the tables. 'Science' means biological science, physical science and mathematics; 'all subjects' includes humanities, social science and medicine as well as science and engineering.

(ii) Postgraduates

Taught
The total output of taught postgraduates in all subjects from UK universities increased by 80% between 1977 and 1988, with UK and overseas students increasing about equally rapidly (figure 4.1). The output of taught engineering & technology postgraduates, however, increased by only 9%, with a drop of 12% between 1987 and 1988. The output of taught science postgraduates increased by 46% during 1977 – 1988, most of the increase occurring after 1983. In both science and engineering & technology, output of UK postgraduates increased more rapidly than overseas postgraduates.

Research
The output of research postgraduates has grown more slowly, with an increase of 30% between 1977 and 1988. In this instance the growth rates for engineering & technology (27%) and science (23%) are closer to the average for all disciplines. The proportions of overseas research postgraduates (49% in engineering & technology, 25% in science) did not change greatly during 1977 – 1988.

The total output from UK universities of research postgraduates in science and engineering in 1988 was 5400, of whom one third were from overseas. This compares with an output of over 20,000 science and engineering doctorates in the USA in 1988, one quarter of them foreign.

Of taught postgraduates, science, engineering & technology together accounted for 35% of total output in 1977 and 25% in 1988; of research postgraduates, by contrast, they accounted for 58% in 1977 and 55% in 1988.

CNAA

For comparison, the output of higher CNAA degrees from polytechnics and colleges is shown in table 4.1. The total output of CNAA research degrees in science and engineering in 1988 was 442, or about 8% of the university output. This was 17% higher than the 1985 total. In 1988, science and engineering accounted for 73% of CNAA research postgraduates.

(iii) Staff numbers and structure

Academic staff

Data on numbers of full-time academic staff are given in table 4.2. The most notable points are as follows.

- The total number of full-time academic staff in 1989/90, 49 390, is 22% greater than the number in 1977/78, and 12% greater than the number in post immediately preceding the 1981 cuts.
- The total number of staff grew between 1977/78 and 1989/90 by 38% for biological science, 39% for mathematics and computing and 32% for engineering & technology, but by only 4% in physical science and by 7% in agricultural and veterinary science.
- The number of full-time staff funded wholly from general university funds (i.e. essentially long-term staff), however, has declined. At 31 340 in 1989/90, it was 5% below the 1977/78 level and 9% below the 1980/81 level. The 1981 cuts led to the permanent loss of 3000 long-term academic posts.
- The proportion of posts funded other than by general funds (typically short-term posts) has almost doubled, from 18.7% of total posts in all disciplines in 1977/78, to 29.8% in 1984/85 and 36.5% in 1989/90. The actual number of such posts has more than doubled since 1977/78, with an average annual growth rate of 7.5%. It is the increase in this category that accounts for the increase in the total number of academic posts; it follows the increasing proportion of university research funded from non-UGC/UFC sources (table 2.7). In science and technology disciplines, the proportion of short-term staff is higher than the average for all disciplines: for example, they constituted 22% and 42% of engineering staff, and 22% and 42% of science staff, in 1977/78 and 1989/90 respectively. The average annual growth rate of short-term staff in science and technology disciplines has been 7.3%.
- Data on computer science separate from mathematics are available only from 1984. Some data on staff numbers in UK universities are given below, from which the rapid growth of computer staff since 1984/85 will be apparent. About 16% of mathematics staff and 36% of computing staff were on short-term contracts in the most recent year.

	1984/85	*1988/89*
Mathematics	1,841	1,813
Computing	1,001	1,527

Short-term staff

The increase in numbers of short-term staff needs further comment. Short-term staff have characteristics (apart from funding) that distinguish them from long-term staff.

(a) As the age analysis in the next section shows, short-term staff are much younger than long-term staff.

(b) About 86% of short-term staff are classified as research only, whereas 97% of long-term staff carry out both research and teaching {1984/85 data}.

(c) Short-term staff are less likely than long-term staff to have a PhD.

It might be thought that short-term staff were typically postdoctoral research assistants engaged for specific projects. In fact, as table 4.3 shows, the majority of short-term staff do not have PhDs, especially in the under 30 age group, and this has, if anything, become more the case since 1977/78. There has been an increasing tendency in recent years for PhD students to take salaried research assistant posts in preference to less remunerative studentships. This trend, coupled with the increase in external funding of academic research, is an important factor in the growth of academic staff on short-term appointments.

Table 4.3 also shows that there has been a general increase across all fields in the proportion of long-term staff holding PhDs. The PhD is particularly evident in biological and physical science, less so in engineering and mathematics and markedly less so in the humanities and social sciences.

Part-time staff
Data on part-time academic staff are given in table 4.4. Numbers of part-time staff expanded rapidly during the period of implementation of the 1981 cuts, possibly as a result of full-time staff taking premature retirement and returning for one, two or three years on a part-time basis. Numbers then stabilized at a level slightly below the peak 1984/85 figure of 3495, roughly double that existing before the 1981 cuts; there was a further marked increase in 1988/89. The proportion of part-time staff doing research only (as opposed to both teaching and research) was fairly constant around 25% up to 1984/85, but then increased to 33% by 1988/89.

Research councils
The numbers of staff employed directly by research councils in their own institutes are given in table 4.5. The data are not always directly comparable between councils, but overall there has been a reduction of about 25% between 1980/81 and 1988/89. This reflects not only changes in the funding available to research councils but also removal of research institutes from research council control (e.g. the Plant Breeding Institute).

(iv) Age profiles

Long-term staff
The age profiles of wholly university funded and, separately, of non university funded academic staff are shown in figure 4.2. For wholly university funded engineers, the main trends are a decrease in the proportion aged 35-39 (17.1% in 1982/83, 13.3% in 1988/89) and increases in the proportion under 30 (3.7% in 1982/83, 6.1% in 1988/89) or over 59 (5.1% in 1982/83, 6.4% in 1988/89). To some extent these reflect recovery from the conditions prevailing in the wake of the 1981 cuts in university funding. An ageing population is more strongly evident among wholly university funded scientists: the proportion aged under 40 declined from 47.5% in 1977/78 to 27.7% in 1988/89, while the proportion aged 45-49 rose from 13.4% in 1977/78 to 21.1% in 1983/84 and then stabilized, the proportion aged 50-54 rose continuously from 10.4% in 1977/78 to 19.3% in 1988/89 and the proportion aged 55-59 rose from 5.9% in 1977/78 to 9.0% in 1981/82 before stabilizing.

Short-term staff
The age profiles of non university funded academic staff are very different, as one would expect. 55%-60% of non university funded engineers are aged under 30, and more than 20% are 30-34. There are few trends, though it is interesting to note that the proportion aged 40-44 rose from 2.9% in 1977/78 to 5.2% in 1988/89. As before, the trends are stronger among the scientists: the proportion aged under 30 declined from 64.4% in 1977/78 to 56.0% in 1988/89, while the proportion aged 40-44 rose from 2.1% to 5.2%. In 1988/89 there were 797 scientists and engineers aged over 39 on short-term contracts in UK universities, in contrast to just 216 in 1977/78.

(v) Staff movements

Sources of recruits
The numbers of full-time academic staff recruited to the UK university system each year, and some of the sources from which they were recruited, are shown in table 4.6.

The annual rate of recruitment to wholly university funded posts in the earlier years was around 5% of the total number of such posts, dropped to half that immediately following the 1981 cuts and has since mostly recovered. The rate of recruitment to short- term posts was much higher, around 30%, and was not significantly affected by the 1981 cuts. Apart from agriculture & veterinary science, the rate of recruitment in scientific and technological disciplines was consistently below the average for long-term posts and above the average for short-term posts.

Recruitment to long-term posts in all disciplines from UK postgraduate courses and from UK educational institutions other than universities (i.e. mainly polytechnics) declined, particularly in science disciplines.

Recruitment from overseas remained steady at around 17.5% of all recruits. A significant proportion of recruits from overseas would have been UK citizens: a study of migration published by SEPSU in 1987 found that 10% of scientists and engineers coming from overseas to take short-term academic posts, and 64% of those taking long-term academic posts, were UK citizens. Of recruits to short-term posts, almost half (and over half for science disciplines) consistently came from UK postgraduate courses. About 14% of all recruits to short-term posts (20% for science disciplines) came from overseas. Relatively few came from UK educational institutions other than universities.

Table 4.7 shows the proportion of short-term staff who in any one year succeed in securing long-term academic posts. For all subjects combined this figure was initially 4-5%; it halved during implementation of the 1981 cuts but had recovered by 1984/85. It has subsequently dropped a little. A similar trend is observable if movements are expressed as a proportion of numbers already in long-term posts. There are considerable differences between disciplines. In relation to numbers in short-term posts, mathematicians are much the most likely to secure long-term posts, and biologists the least likely. In relation to numbers already in long-term posts, however, engineers and agriculturists appear to have the best chances of securing long-term posts.

Destinations on leaving

The destinations of staff leaving academic posts are analysed in table 4.8. The data on wholly university funded staff are distorted by the large scale retirements during 1982/83 and 1983/84. For staff leaving short-term posts, the most striking feature is the number going into (at least temporary) unemployment, up from 30% in 1977/78 to a steady 50% in the most recent years. The proportion going into UK industry has been fairly constant, and is twice as high for engineers (about 25%) as for scientists.

Migration

Data on migration of academic staff to and from the UK are given in table 4.9. There were substantial oscillations in the earlier years, but in every year since 1983/84 there has been a marked net inflow to the UK. Analysis of migration patterns by grade, however, shows a net outflow of staff in the reader/senior lecturer grades in almost every year.

The USR data on migration out of the UK refer only to staff who have held academic posts before leaving. They do not pick up those who leave without having been on a university payroll – e.g. research students who leave immediately after completing their PhDs. The SEPSU migration study found that, in science and engineering, about 9% of research students emigrated on completion of their PhDs, and that this group constituted 42% of total UK scientists and engineers emigrating from the academic sector.

V Adequacy of Resources

In this section we present data on non-research expenditure that may help to explain conflicting opinions regarding adequacy of resources. On the one hand, the Government claims to have increased the money available for research, whereas on the other the research community perceives growing pressure on resources.

(i) Price index

As discussed in section II (i) above, choice of deflator dramatically affects data on 'real' costs. As applied to the Science Base figures, the GDP deflator engenders a more positive view than use of, for example, the UPPI. To date the Government has used the GDP deflator to measure trends in Science Base expenditure; however, the research community may regard the UPPI or some other index as a more accurate reflection of its circumstances.

(ii) Non-research expenditure

Some of the funds for research are spent on items that do not directly buy research, such as superannuation, relocation and redundancy. If such items have increased in proportion to total expenditure, then increases in nominal expenditure for research will not result in corresponding increases in the volume of research. In NERC 'non-research' expenditure has grown from 7% of total expenditure in 1977/78 to 11% in 1987/88. 'Real term' increases in non-research expenditure are evident also for AFRC, ESRC and MRC. For all research councils superannuation costs have risen noticeably over the ten year period. This is particularly evident for the AFRC, where superannuation has increased more than five-fold in 'real' terms during the last ten years. Data are given in table 5.1.

(iii) Expenditure per head

Individual researchers are more likely to be conscious of expenditure per head than of total expenditure. Relevant data are given in table 5.2. Research expenditure per head of long-term academic staff in universities increased in real terms since 1981/82 by 43% (GDP deflator) or 36% (UPPI). The increase is due in part to the fact that the number of long-term staff has declined; it is also affected by incremental salary drift due to an ageing population. These increased resources have been used to fund additional short-term staff; when the latter are included in the calculation, research expenditure per head has still increased, but by 19% (GDP deflator) or 12% (UPPI) since 1981/82.

(iv) Unfunded alpha-graded research proposals

The phenomenon of unfunded alpha-graded research proposals is widely regarded as evidence of inadequate resources. Data are given in table 5.3. The data should not be taken at face value, because of their inherently subjective nature and because unfunded projects are often resubmitted. Also, there will be some non-uniformity between the research councils in usage of the alpha category prior to 1987/88, as ESRC and MRC did not adopt the current alpha grading system until then but approved grants according to a different system. Moreover, the chances of securing funding may be affected by the scope for relating a given proposal to an area targeted for priority funding. Nevertheless, the data in table 5.3 do suggest that competition for funding has increased over the past ten years.

(v) Career choice

Changing perceptions about the desirability of a research career may be documented by analysing trends in the career choices of first class university graduates (table 5.4).

Engineer

Of engineering graduates with first class degrees, the proportion choosing to continue into postgraduate work dropped from 21.9% in 1978 and 22.5% in 1980 to 16.9% in 1987. Of engineering graduates with first class degrees going straight into permanent employment in the UK, the proportion going into industry dropped from 87.3% in 1978 to 76.5% in 1987, and the proportion going into commerce rose from 3.3% to 16.3%; the proportion taking R & D jobs fell from 78.1% in 1982 to 66.0% in 1987, and the proportion taking jobs in management and financial services rose from 4.4% to 18.5%.

Scientists

First class scientists are more likely than engineers to continue their studies, but still show a downward trend (54.3% in 1978, 47.3% in 1987). For those going straight into permanent employment in the UK, first class scientists are also more likely to seek careers in commerce (30.6% in 1978, 46.1% in 1987) and to undertake management and financial work (48.6% in 1982, 55.4% in 1987). These figures suggest that research – particularly academic research – is becoming less attractive to the brightest graduates.

(vi) Teaching load

Undergraduates

Table 5.5 (i) shows trends in undergraduate teaching load per UGC-funded member of academic staff. In all subjects, there have been significant increases both during the 1981 cuts in university funding and again in more recent years.

Postgraduates

For all science subjects combined the postgraduate teaching load per member of staff (excluding supervision of research postgraduates) increased by two-thirds between 1980/81 and 1988/89 (table 5.5 (ii)). Rates of growth, and absolute values, vary considerably between disciplines.

The total teaching load per full-time UGC-funded member of academic staff therefore increased noticeably between 1980/81 and 1988/89.

VI Conclusions

The health of the UK Science Base is an amalgam of many factors. In this report we have presented data on trends in some of the key characteristics of the Science Base. The main conclusions are as follows.

(i) Total expenditure on the Science Base in 'real' terms cannot sensibly be identified in the absence of a suitable deflator. No such deflator is currently available. Our use of the GDP deflator and of UPPI in this report should not be taken to imply that we regard either of these indices as necessarily suited to measuring trends in research costs.

(ii) The total income of the Science Base from all sources has increased in 'real' terms since 1977/78. This increase has been driven largely by an increase in income from non-DES sources. The income of the Science Base from DES sources rose by 19% in 'real' (GDP deflator) terms between 1977/78 and 1990/91, but is planned to fall by 6% between 1990/91 and 1992/93; however, UPPI gives only a 3% rise in 'real' terms between 1977/78 and 1988/89.

(iii) External (i.e. non-UGC) funding of research in university departments of science, agriculture and engineering increased by 9% per year in 'real' (GDP deflator) terms between 1981/82 and 1988/89. The number of short-term staff in these departments increased by 7% per year during the same period.

(iv) Expenditure from general income on technical staff dropped in 'real' (GDP deflator) terms by 13% between 1980/81 and 1988/89.

(v) The output of postgraduates in engineering and in science has grown, but significantly more slowly than in other disciplines. In both subjects, substantial numbers of students are domiciled overseas and on graduating return to their home countries.

(vi) Numbers of full-time academic staff in all disciplines combined grew by 22% between 1977/78 and 1989/90, but only because a 139% increase in short-term posts compensated for a 5% drop in long-term posts. In some disciplines (physical science, agricultural & veterinary science) there has been only a small increase in total staff numbers. Numbers of part-time staff in all disciplines combined have more than doubled.

(vii) The age profile of academic staff, particularly those in science disciplines, has become markedly older over the last ten years.

(viii) The annual rate of recruitment to academic posts appears to have recovered to pre-1981 levels.

(ix) There is no evidence from USR data of a net outflow of researchers holding full-time academic appointments from the UK, except perhaps at the reader/senior lecturer level. However, these data do not take account of research students who emigrate on completion of their PhDs.

(x) There have been significant increases in the proportion of total Science Base expenditure going on items that do not directly support research.

(xi) There is evidence that the brightest graduates are increasingly moving away from careers in research.

(xii) The teaching load per full-time UGC-funded member of academic staff has increased significantly since 1980/81.

TABLES AND FIGURES

Table 2.1 Salary of 39 year old university lecturer at the age-related point on the normal lecturer scale

	Salary		UPPI (all recurrent items)	Index of total recurrent income UK universities	GDP deflator	RPI
	(£, cash)	Index				
October 1978	8,182	100	100	100	100	100
October 1979	9,568	117	115	126	117	117
October 1980	11,947	146	152	156	138	135
October 1981	12,305	150	164	171	152	151
October 1982	12,920	158	173	187	163	161
October 1983	14,125	173	182	198	170	169
October 1984	14,925	182	191	211	179	178
October 1985	15,700	192	201	229	188	188
October 1986	15,700	192	214	250	195	193
October 1987	18,210	226	237	273	205	202
October 1988	19,310	236	251	310	220	215
October 1989	20,469	250	268	n/a	234	230
October 1990	22,311	273	285	n/a	249	253

Table 2.2 Science Base funding from DES sources as a proportion of GDP

	77/78	78/79	79/80	80/81	81/82	82/83	83/84	84/85
Science Base funding from DES sources (£M, cash terms)	475.1	541.6	638.7	767	869.4	928.5	993.3	1,040.4
GDP* (£Bn, cash terms)	151.1	173.4	208.1	237.2	260.4	284.9	309.3	331.1
Science Base/ GDP %	0.314	0.312	0.307	0.323	0.334	0.326	0.321	0.314

	85/86	86/87	87/88	88/89	89/90	90/91	91/92	92/93
Science Base funding from DES sources (£M, cash terms)	1,106.1	1,177.6	1,263	1,341.5	1,464.5	1,554.4	1,567.3	1,584.6
GDP* (£Bn, cash terms	361.9	388.2	430.4	478.1	519	558	596	633
Science Base/ GDP %	0.306	0.303	0.293	0.281	0.282	0.279	0.263	0.25

(* There are several different ways of calculating GDP. The one used here is GDP at market prices," as defined for GDP (A) in the Treasury circular of 20 March 1990)

Table 2.3 UK Science Base income from DES and non-DES sources (£M, cash terms)

Source	1977/78	1978/79	1979/80	1980/81	1981/82	1982/83	1983/84	1984/85	1985/86	1986/87	1987/88	1988/89
DES	475.1	541.6	638.7	767.0	869.4	928.5	993.3	1,040.4	1,106.1	1,177.6	1,263.0	1,341.5
non-DES	116.5	135.7	171.7	206.4	215.4	242.1	270.4	311.6	373.3	428.9	481.6	557.6
non-DES as % of total	19.7%	20.0%	21.2%	21.2%	19.9%	20.7%	21.4%	23.0%	25.2%	26.7%	27.6%	29.4%
Total	591.6	677.3	810.4	973.4	1,084.8	1,170.6	1,263.7	1,352.0	1,479.4	1,606.5	1,744.6	1,899.1
1990 pounds (GDP deflator)	*1,632.6*	*1,688.6*	*1,729.7*	*1,755.7*	*1,782.1*	*1,793.5*	*1,849.8*	*1,885.5*	*1,958.2*	*2,056.6*	*2,119.7*	*2,154.0*
1990 pounds (UPPI)	*1,872.2*	*1,902.7*	*1,971.7*	*1,796.0*	*1,857.5*	*1,900.3*	*1,950.2*	*1,985.3*	*2,069.1*	*2,108.3*	*2,067.1*	*2,124.3*
	*	*	*	*								

Definitions:

DES: Total Science Base, as in table 2.4

Non-DES: Total research council income, less PGA, as in table 2.5 PLUS total university non-UGC research income, less research councils component, as in table 2.7

Notes:

* Breakdown of non-DES income to universities unavailable for these years, therefore research council component of universities income has been calculated pro rata on 1981/82 figures

Table 2.4 UK Science Base income from DES sources (£M, cash terms)

	1977/78	1978/79	1979/80	1980/81	1981/82	1982/83	1983/84	1984/85	1985/86	1986/87	1987/88	1988/89	1989/90	1990/91	1991/92	1992/93
AFRC (cash)	20.9	26.3	29.5	37.5	42.0	43.6	45.8	46.7	52.7	57.1	54.9	61.2	74.3	85.9	91.8	88.4
1990 pounds (GDP deflator)	*57.7*	*65.6*	*63.0*	*67.6*	*69.0*	*66.8*	*67.1*	*65.1*	*69.8*	*73.2*	*66.7*	*69.4*	*79.1*	*85.9*	*87.6*	*81.5*
1990 pounds (UPPI)	*66.1*	*73.9*	*71.8*	*69.1*	*71.9*	*70.8*	*70.7*	*68.5*	*73.7*	*75.0*	*65.0*	*68.5*	*77.6*	*85.9*		
ESRC (cash)	13.6	15.5	16.8	20.2	20.7	20.7	22.9	22.0	23.6	23.8	24.8	27.7	32.0	36.0	35.2	35.8
1990 pounds (GDP deflator)	*37.5*	*38.6*	*35.9*	*36.4*	*34.0*	*31.7*	*33.5*	*30.7*	*31.2*	*30.5*	*30.1*	*31.4*	*34.1*	*36.0*	*33.6*	*33.0*
1990 pounds (UPPI)	*43.0*	*43.5*	*40.9*	*37.3*	*35.4*	*33.6*	*35.3*	*32.3*	*33.0*	*31.2*	*29.4*	*31.0*	*33.4*	*36.0*		
MRC (cash)*	41.3	47.0	57.2	72.7	101.5	107.5	113.7	117.2	122.3	128.3	139.8	149.7	176.3	185.7	192.0	195.2
1990 pounds (GDP deflator)	*114.0*	*117.2*	*122.1*	*131.1*	*166.7*	*164.7*	*166.4*	*163.4*	*161.9*	*164.2*	*169.9*	*169.8*	*187.8*	*185.7*	*183.3*	*180.0*
1990 pounds (UPPI)	*130.7*	*132.0*	*139.2*	*134.1*	*173.8*	*174.5*	*175.5*	*172.1*	*171.0*	*168.4*	*165.6*	*167.4*	*184.2*	*185.7*		
NERC (cash)	27.9	32.1	36.6	46.7	54.3	58.0	61.6	65.3	67.9	70.3	73.3	91.9	115.0	135.2	121.3	117.1
1990 pounds (GDP deflator)	*77.0*	*80.0*	*78.1*	*84.2*	*89.2*	*88.9*	*90.2*	*91.1*	*89.9*	*90.0*	*89.1*	*104.2*	*122.5*	*135.2*	*115.8*	*108.0*
1990 pounds (UPPI)	*88.3*	*90.2*	*89.1*	*86.2*	*93.0*	*94.2*	*95.1*	*95.9*	*95.0*	*92.3*	*86.8*	*102.8*	*120.2*	*135.2*		
SERC (cash)	136.8	153.3	175.6	201.4	216.8	234.4	254.3	278.8	298.4	316.2	357.5	369.3	406.7	438.6	437.4	444.2
1990 pounds (GDP deflator)	*377.5*	*382.2*	*374.8*	*363.3*	*356.2*	*359.1*	*372.3*	*388.8*	*395.0*	*404.8*	*434.4*	*418.9*	*433.1*	*438.6*	*417.6*	*409.7*
1990 pounds (UPPI)	*432.9*	*430.6*	*427.3*	*371.6*	*371.2*	*380.5*	*392.4*	*409.4*	*417.3*	*415.0*	*423.6*	*413.1*	*425.0*	*438.6*		
Total Research Councils (cash)	240.5	274.2	315.7	378.5	435.3	464.2	498.3	530.0	564.9	595.7	650.3	699.8	804.3	881.4	877.7	880.7
1990 pounds (GDP deflator)	*663.7*	*683.6*	*673.9*	*682.6*	*715.1*	*711.3*	*729.4*	*739.1*	*747.7*	*762.6*	*790.1*	*793.7*	*856.6*	*881.4*	*837.9*	*812.3*
1990 pounds (UPPI)	*761.1*	*770.2*	*768.1*	*698.3*	*745.4*	*753.6*	*769.0*	*778.2*	*790.1*	*781.8*	*770.5*	*782.8*	*840.4*	*881.4*		
Science Budget (cash)	245.1	276.6	318.7	382.0	439.4	468.5	503.3	535.4	571.1	602.6	658.0	709.0	817.0	896.9	912.3	934.6
1990 pounds (GDP deflator)	*676.4*	*689.6*	*680.3*	*689.0*	*721.8*	*717.8*	*736.7*	*746.6*	*756.0*	*771.5*	*799.5*	*804.2*	*870.1*	*896.9*	*870.9*	*862.0*
1990 pounds (UPPI)	*775.6*	*777.0*	*775.4*	*704.8*	*752.4*	*760.6*	*776.7*	*786.2*	*798.8*	*790.9*	*779.6*	*793.1*	*853.7*	*896.9*		

Table 2.4 UK Science Base income from DES sources (£M, cash terms) (continued)

	1977/78	1978/79	1979/80	1980/81	1981/82	1982/83	1983/84	1984/85	1985/86	1986/87	1987/88	1988/89	1989/90	1990/91	1991/92	1992/93
University Funding (cash)	230.0	265.0	320.0	385.0	430.0	460.0	490.0	505.0	535.0	575.0	605.0	632.5	647.5	657.5	655.0	650.0
1990 pounds (GDP deflator)	*634.7*	*660.6*	*683.0*	*694.4*	*706.4*	*704.8*	*717.3*	*704.3*	*708.1*	*736.1*	*735.1*	*717.4*	*689.6*	*657.5*	*625.3*	*599.5*
1990 pounds (UPPI)	*727.8*	*744.4*	*778.6*	*710.3*	*736.3*	*746.8*	*756.2*	*741.6*	*748.3*	*754.6*	*716.8*	*707.5*	*676.6*	*657.5*		
Total Science Base (cash)	475.1	541.6	638.7	767.0	869.4	928.5	993.3	1,040.4	1,106.1	1,177.6	1,263.0	1,341.5	1,464.5	1,554.4	1,567.3	1,584.6
1990 pounds (GDP deflator)	*1,311.1*	*1,350.2*	*1,363.3*	*1,383.4*	*1,428.2*	*1,422.6*	*1,454.0*	*1,450.9*	*1,464.1*	*1,507.6*	*1,534.6*	*1,521.6*	*1,559.7*	*1,554.4*	*1,496.2*	*1,461.6*
1990 pounds (UPPI)	*1,503.5*	*1,521.3*	*1,554.0*	*1,415.1*	*1,488.7*	*1,507.3*	*1,532.9*	*1,527.7*	*1,547.0*	*1,545.5*	*1,496.4*	*1,500.6*	*1,530.3*	*1,554.4*		

Sources:

Outturn figures for the research councils 1977/78–1988/89 from research council Annual Reports.

Figures for university research funding from the Universities Funding Council until 1987/88, then Annual Review of Government Funded R&D.

Figures for The Royal Society and The Fellowship of Engineering (included in the Science Budget total) from Supply Estimates 1977/78–1988/89.

Allocations for the research councils and Science Budget 1990 through 1992 from ABRC Allocations of the Science Budget 1990–1993.

Definitions:

Total research councils refers to total receipts of the research councils from Parliamentary Grant-in-Aid via the DES.

Science Budget includes the five research councils, The Royal Society and The Fellowship of Engineering.

Total Science Base includes Science Budget and university allocations.

Notes:

Research council figures for each year refer to receipts from Parliamentary Grant-in-Aid via the DES.

Science Budget figures exclude allocations for British Museum (Natural History) throughout.

University figures refer to research funding from UGC/UFC via the DES. They:

- include social science (£85M in 1989/90: table 9a in the 1990 Annual Review).
- exclude humanities research (£75M in 1989/90: table 9a in the 1990 Annual Review).
- exclude medical science directed towards clinical ends ('primary purpose 7'; £92.5M in 1989/90: table 9a in the 1990 Annual Review).

NERC: increase in funding in 1988/89 was to cover British Antarctic Survey capital expenditure, mainly construction of RRS James Clark Ross."

* MRC figures increased 1981/82 onwards by 'reverse Rothchild' transfer from DHSS

Table 2.5 Research Council income by source (£K, cash terms)

	1977/78	1978/79	1979/80	1980/81	1981/82	1982/83	1983/84	1984/85	1985/86	1986/87	1987/88	1988/89
AFRC												
PGA via DES	20,882	26,304	29,501	37,477	41,934	43,624	45,840	46,680	52,725	57,149	54,896	61,112
MAFF	24,713	26,780	30,413	37,387	44,317	48,539	50,939	52,135	51,644	47,920	44,196	46,381
Other commissions/contributions	1,792	1,795	2,376	3,709	4,070	4,627	5,329	5,878	9,340	10,940	13,614	6,610
Total commissions/contributions	26,505	28,575	32,789	41,096	48,387	53,166	56,268	58,013	60,984	58,860	57,810	52,991
Total receipts	47,387	54,879	62,290	78,573	90,321	96,790	102,108	104,693	113,709	116,009	112,706	114,103
1990 pounds (GDP deflator)	*130,770*	*136,811*	*132,959*	*141,719*	*148,376*	*148,296*	*149,469*	*146,001*	*150,508*	*148,509*	*136,939*	*129,418*
ESRC												
PGA via DES	13,620	15,485	16,765	20,219	20,656	20,651	22,440	21,979	23,587	23,820	24,845	27,007
Government commissions	100	174	202	164	204	142	165	212	190	288	749	1,229
Other commissions/contributions	52	79	172	203	95	112	127	261	149	137	74	95
Total commissions/contributions	152	253	374	367	299	254	292	473	339	425	823	1,324
Total receipts	13,923	15,738	17,139	20,586	20,955	20,905	22,732	22,452	23,926	24,245	25,686	28,338
1990 pounds (GDP deflator)	*38,422*	*39,234*	*36,583*	*37,130*	*34,424*	*32,029*	*33,276*	*31,311*	*31,669*	*31,037*	*31209*	*32,142*
MRC												
PGA via DES	41,349	46,979	57,240	72,737	101,524	107,502	113,709	117,152	122,310	128,340	139,801	149,677
Government commissions	8,515	10,204	10,605	13,052	621	659	659	635	535	596	407	380
Other Government contributions	3,182	3,360	3,715	3,950	1,591	1,746	1,535	1,732	2,014	2,356	2,226	3,164
Other commissions/contributions	1,216	1,298	2,090	3,195	2,835	3,086	3,867	4,208	4,306	4,605	5,775	8,771
Total commissions/contributions	1,291	14,862	16,409	20,197	5,047	5,491	6,061	6,575	6,855	7,556	8,408	12,315
Total receipts	54,261	61,841	73,649	92,934	106,571	112,993	119,770	123,727	129,165	137,597	149,967	164,238
1990 pounds (GDP deflator)	*149,740*	*154,166*	*157,205*	*167,621*	*175,070*	*173,121*	*175,323*	*172,545*	*170,966*	*176,144*	*182,211*	*186,283*

Table 2.5 Research Council income by source (£K, cash terms) (continued)

	1977/78	1978/79	1979/80	1980/81	1981/82	1982/83	1983/84	1984/85	1985/86	1986/87	1987/88	1988/89
NERC												
PGA via DES	27,911	32,105	36,114	46,730	54,291	58,035	62,500	65,303	67,880	70,325	73,315	91,859
Government commissions	18,156	17,222	19,433	24,113	25,898	23,098	20,789	20,563	21,543	23,175	20,804	23,154
Other commissions/contributions	783	1,234	1,043	665	1,666	1,102	943	1,011	1,424	7,604	7,624	8,325
Total commissions/contributions	18,939	18,456	20,476	24,778	27,564	24,200	21,732	21,574	22,967	30,779	28,428	31,479
Total receipts	46,850	50,561	58,694	74,859	86,598	87,819	89,825	93,132	99,924	105,498	106,444	127,901
1990 pounds (GDP deflator)	*129,288*	*126,045*	*125,283*	*135,020*	*142,260*	*134,551*	*131,488*	*129,879*	*132,262*	*135,053*	*129,330*	*145,068*
SERC												
PGA via DES	136,790	153,301	175,583	201,446	216,735	234,402	254,495	278,827	298,388	316,187	357,462	367,632
Government commissions	516	914	1,318	2,017	2,374	2,872	4,242	7,232	10,876	11,766	17,766	18,483
Other commissions/contributions	2,535	3,224	4,291	4,444	5,542	6,460	5,751	5,111	7,136	8,163	10,952	13,142
Total commissions/contributions	3,051	413	5,609	6,461	7,916	9,332	9,993	12,343	18,012	19,957	28,718	31,625
Total receipts	140,044	157,667	181,414	208,245	225,079	244,177	264,527	291,426	317,617	337,215	386,703	397,139
1990 pounds (GDP deflator)	*349,124*	*393,057*	*387,231*	*375,602*	*369,752*	*374,114*	*387,222*	*406,412*	*420,406*	*431,685*	*469,847*	*450,445*

Source: 1977/78–1988/89: research council annual reports,
Notes: Government commissions, main sources:
MRC – DHSS until 1980/81, then Health and Safety Executive; NERC – Dept. of Environment, Dept. of Energy, SERC – DTI and M o D.
Other commissions/contributions, main sources:
AFRC – sale of produce; ESRC – sales and publications, Leverhulme Trust 1980 – 1982;
MRC – Area Health Authorities, World Health Organization, private donations.
NERC – European Communities; SERC – NATO, canteen/hostel receipts.
NERC – Breakdown of commissions 1980/81 estimate only
Total receipts includes additional miscellaneous receipts.

Table 2.6 (i) AFRC income from sources other than DES (£K, cash terms)

	1977/78	1978/79	1979/80	1980/81	1981/82	1982/83	1983/84	1984/85	1985/86	1986/87	1987/88	1988/89
Government Departments:												
D o Empl	2	2	1							n/a	n/a	n/a
D o Env	3	17	2				3	15	58	n/a	n/a	n/a
DHSS	31	30	44	3	30					n/a	n/a	n/a
DTI			469	488	411	304	348	139	27	n/a	n/a	n/a
HSE			20		59	30	38	36	75	n/a	n/a	n/a
MAFF (open contracting)	105	117	12	188	266	188	196	241	256	n/a	n/a	1,554
ODA	244	373	487	500	604	726	668	656	877	n/a	n/a	n/a
EC	12		90	238	184	275	331	689	684	n/a	n/a	1,173
Total from Government + EC	394	537	1,123	1,416	1,555	1,522	1,585	1,776	1,977	3,549	4,501	6,230

Source: Annual Reports. For AFRC income from MAFF commissions under the Rothschild arrangements, see table 2.5

Table 2.6 (ii) MRC income from sources other than DES (£K, cash terms)

	1977/78	1978/79	1979/80	1980/81	1981/82	1982/83	1983/84	1984/85	1985/86	1986/87	1987/88	1988/89
Government Departments:												
D o Empl	178	211	50	1		53	57	31				
D o Env	8	13	13	4	4							
DHSS	10,073	11,793	12,460	15,315	392	477	188	274	265	338	344	966
DTI	60	77	24							65	24	
HSE	669	576	631	539	621	659	659	635	535	596	407	380
Home Office				10	7	2						
MAFF			20	6					27	32	31	7
M o D	77	76	83	117	86	51	60	49	62	107	141	132
ODA	617	806	1,037	967	1,083	1,150	1,220	1,366	1,652	1,742	1,630	1,800
Others	15	11	43	43	18	13	10	12	9	36	57	259
Total from Government	11,697	13,564	14,320	17,002	2,212	2,405	2,194	2,367	2,549	2,916	2,633	3,544
Europe												
EC – Euratom	53	41	67	63	142	169	206	408	283			
EC – other	16	55	65	90	9	12				454	299	472
Total from EC	69	96	132	153	151	181	206	408	283	454	299	472

From 1 April 1981, the commissioning funds from the Health Department were returned to the Science Vote.

Source: Annual Reports

Table 2.6 (iii) NERC income from sources other than DES (£K, cash terms)

	1977/78	1978/79	1979/80	1980/81	1981/82	1982/83	1983/84	1984/85	1985/86	1986/87	1987/88	1988/89
Government Departments:	*	*	*									
D o Ener	7,396	5,718	9,015	8,170	10,440	9,613	8,277	8,253	7,788	8,078	5,320	6,232
D o Envr	4,336	4,482	5,486	7,997	8,173	5,648	4,797	4,910	5,062	5,272	4,357	4,673
DTI	3,063	3,368	3,338	3,068	2,765	2,672	2,561	2,353	2,215	2,198	2,326	2,284
MAFF	1,120	1,198	1,390	1,724	1,940	2,019	2,062	2,143	2,188	2,558	2,708	2,847
M o D										376	738.	
NCC	645	613	390	396	305	280	182	215	364	501	519	518
NI D o Econ. Dev										315	326	302
ODA	1,596	1,843	2,080	2,200	2,274	2,866	2,909	2,689	3,926	3,748	4,356	4,748
Others	744	1,082	1,285	282	571	290	178	385	464	129	154	1,550
Total Govt. contributions	18,900	18,304	22,983	23,837	26,469	23,387	20,967	20,948	22,006	23,175	20,804	23,154
EC	39	152	376	383	1,096	812	765	626	960	881	1,204	1,473

Notes: * For these years figures are for expenditure, not income

Source: Annual Reports

Table 2.6 (iv) SERC income from sources other than DES (£K, cash terms)

	1984/85	1985/86	1986/87	1987/88	1988/89
Industry	1,187	592	889	1,118	3,748
Public corporation	102	291	268	369	430
Total private sector	1,289	883	1,167	1,487	4,178
Total public sector	7,417	11,651	10,952	17,790	17,435
Overseas	1,808	3,276	4,836	6,194	6,004
Other	1,831	2,201	2,844	3,174	4,198
Total	12,345	18,011	19,799	28,645	31,815

Source: SERC Output and Performance Indicators for the Science Base 1990

Table 2.7 University research income from sources other than UGC (£K, cash terms)

	1977/78	1978/79	1979/80	1980/81	1981/82	1982/83	1983/84	1984/85	1985/86	1986/87	1987/88	1988/89
Research Councils	43,961	56,882	79,104	n/a	104,131	119,168	135,479	147,453	162,194	183,976	187,857	215,516
1990 pounds (GDP deflator)				n/a	*171,063*	*182,583*	*198,318*	*205,633*	*214,684*	*235,516*	*228,248*	*244,443*
UK Government	62,864	81,342	113,120	n/a	n/a	51,523	58,329	64,301	75,951	863,29	93,355	105,372
1990 pounds (GDP deflator)	*173,480*	*202,782*	*241,457*	n/a	*n/a*	*78,941*	*85,384*	*89,672*	*100,531*	*110,514*	*113,427*	*119,515*
UK Charities				n/a	n/a	n/a	n/a	57,230	72,757	93,121	110,009	132,558
1990 pounds (GDP deflator)				n/a	*n/a*	*n/a*	*n/a*	*79,811*	*96,303*	*119,209*	*133,662*	*150,350*
UK industry				n/a	n/a	27,031	32,664	47,688	59,315	68,556	78,632	93,111
1990 pounds (GDP deflator)				n/a	*n/a*	*41,415*	*47,815*	*66,504*	*78,511*	*87,762*	*95,538*	*105,609*
Other	38,703	47,442	61,137	n/a	121,065	65,097	79,409	36,877	45,803	56,176	68,444	92,124
1990 pounds (GDP deflator)	*106,805*	*118,271*	*130,498*	n/a	*198,881*	*99,738*	*116,241*	*51,427*	*60,626*	*71,914*	*83,160*	*104,489*
Total research grants and contracts *	101,567	128,784	174,257	204,408	225,196	262,819	305,880	353,549	416,020	488,156	538,296	638,681
1990 pounds (GDP deflator)	*280,285*	*321,053*	*371,955*	*368,681*	*369,944*	*402,677*	*447,756*	*493,047*	*550,655*	*624,912*	*654,034*	*724,407*

Source: USR University Statistics, Volume 3.

Notes: Information prior to 1980 not available. Complete breakdown of income not available before 1984/85.

*All disciplines combined: figures for science and engineering only are not readily available.

Total research expenditure for engineering and technology, agriculture and veterinary science, and science is given below:

	1981/82	1982/83	1983/84	1984/85	1985/86	1986/87	1987/88	1988/89
£K cash terms	118,182	138,400	157,906	184,300	217,187	253,515	269,300	313,522
1990 pounds (GDP deflator)	*194,145*	*212,049*	*231,147*	*257,018*	*287,475*	*324,537*	*327,202*	*355,604*

Table 2.8 Specific* research income per FTE academic staff (£ cash terms)

	1984/1985	1985/1986	1986/1987	1987/1988	1988/1989
Cost centre:					
Biochemistry	23,990	28,330	32,430	37,310	48,450
1990 pounds (GDP deflator)	*33,456*	*37,498*	*41,515*	*45,332*	*54,953*
Mechanical, aero and production engineering	20,810	25,570	28,980	27,810	30,950
1990 pounds (GDP deflator)	*29,021*	*33,845*	*37,099*	*33,789*	*35,104*
Physics	20,160	24,850	28,300	31,550	40,710
1990 pounds (GDP deflator)	*28,114*	*32,892*	*36,228*	*38,333*	*46,174*

* research income to the cost centre from grants and contracts from all sources

Source: CVCP/UFC University Management Statistics and Performance Indicators

'FTE academic staff' covers all academic staff whose salary costs are borne wholly from general university funds and, pro rata, those partly covered by general university funds. It excludes externally funded staff (e.g. short term contract staff).

Table 3.1 Distribution of research council expenditure by broad disciplinary area

Table 3.1 (a) AFRC

	1980/1981	1981/1982	1982/1983	1983/1984	1984/1985	1985/1986	1986/1987	1987/1988	1988/1989
Animals	39.8%	38.7%	40.1%	36.2%	38.7%	37.7%	38.5%	37.0%	39.1%
Plants and soils	45.8%	45.3%	43.5%	48.0%	50.9%	50.9%	39.4%	39.0%	37.8%
Food science and technology	8.3%	8.6%	9.3%	9.1%	10.5%	11.3%	16.5%	17.9%	17.2%
Other	6.1%	7.3%	7.1%	6.7%	n/a	n/a	5.6%	6.1%	5.9%
Total expenditure £M (cash)	78.5	90.4	97.2	101.8	104.4	112.3	112.4	105.9	113.8
1990 pounds (GDP deflator)	*141.6*	*148.5*	*148.9*	*149.0*	*145.6*	*148.6*	*143.8*	*128.7*	*129.1*

Source: AFRC Annual Reports

Definitions: Other includes engineering technology, industrial technology and building technology

Notes: breakdown percentages exclude administration and research grants.

Table 3.1 (b) MRC

	1977/1978	1978/1979	1979/1980	1980/1981	1981/1982	1982/1983	1983/1984	1984/1985	1985/1986	1986/1987	1987/1988	1988/1989
Physiological systems and disorders	29.2%	30.4%	29.1%	28.0%	26.8%	29.1%	28.7%	30.5%	34.4%	28.4%	29.0%	29.7%
Neurosciences and mental health	16.9%	18.1%	17.0%	18.5%	18.2%	17.5%	17.8%	19.2%	19.0%	19.8%	19.5%	19.2%
Cell biology and disorders	26.1%	25.2%	25.8%	27.3%	28.5%	28.4%	28.7%	28.1%	29.5%	31.2%	30.9%	31.0%
Tropical medicine	5.7%	5.7%	6.3%	6.0%	6.4%	6.7%	6.7%	6.4%	6.0%	5.8%	5.7%	5.9%
Environment	11.6%	10.4%	10.3%	10.0%	9.5%	8.9%	8.5%	7.7%	7.0%	6.8%	6.8%	6.2%
Nutrition	2.1%	2.1%	2.2%	2.0%	1.9%	2.0%	2.0%	1.9%	2.1%	2.1%	2.3%	2.2%
Services and techniques	8.4%	8.0%	9.4%	8.2%	8.6%	7.3%	7.7%	6.3%	5.9%	5.8%	5.7%	5.8%
Total expenditure £M (cash)	54.4	61.8	73.7	92.9	106.5	112.9	119.8	123.8	129.0	137.6	149.6	163.4
1990 pounds (GDP deflator)	*150.2*	*154.0*	*157.2*	*167.6*	*175.0*	*172.9*	*175.3*	*172.6*	*170.8*	*176.0*	*181.8*	*185.3*

Source: MRC Annual Reports

Notes: Breakdown is for expenditure exclusive of studentships, international subscriptions and new building.

Table 3.1 (c) NERC

	1977/78	1978/79	1979/80	1980/81	1981/82	1982/83	1983/84	1984/85	1985/86	1986/87	1987/88	1988/89
Solid earth	52.5%	47.7%	51.3%	49.3%	52.8%	44.3%	48.0%	48.8%	47.8%	44.6%	42.5%	42.4%
Seas	23.6%	26.1%	24.4%	26.5%	25.8%	32.1%	24.6%	23.2%	24.5%	27.9%	26.8%	27.2%
Inland waters	10.0%	11.0%	10.0%	9.5%	8.7%	9.0%	9.8%	9.8%	10.1%	9.9%	9.7%	9.1%
Terrestrial environment	10.2%	12.0%	11.2%	11.5%	9.7%	11.5%	13.4%	13.6%	13.4%	13.6%	16.0%	15.2%
Atmosphere	3.7%	3.2%	3.1%	3.2%	3.0%	3.1%	4.2%	4.5%	4.2%	4.0%	5.0%	6.1%
Total expenditure £M	48.1	51.5	58.7	75.3	86.1	87.4	89.5	93.0	100.1	105.4	106.4	128.1
1990 pounds (GDP deflator)	*132.8*	*128.4*	*125.3*	*135.8*	*141.5*	*133.9*	*131.0*	*129.7*	*132.6*	*134.9*	*129.2*	*145.3*

Source: NERC Annual Reports

Table 3.1 (d) SERC

	1977/78	1978/79	1979/80	1980/81	1981/82	1982/83	1983/84	1984/85	1985/86	1986/87	1987/88	1988/89
Astronomy, space and radio	20.8%	19.0%	17.9%	17.3%	17.7%	17.1%	16.6%	17.3%	17.1%	15.7%	15.3%	17.2%
Engineering	15.7%	15.8%	18.2%	19.9%	22.7%	22.8%	23.8%	25.9%	28.3%	29.0%	27.7%	26.3%
Nuclear physics	31.6%	31.1%	26.9%	21.6%	20.7%	21.6%	21.9%	21.8%	21.2%	21.8%	23.0%	22.7%
Science	23.2%	26.2%	28.5%	32.0%	29.1%	28.3%	26.6%	26.6%	27.0%	26.8%	25.5%	27.3%
Central support	4.5%	3.9%	5.4%	5.3%	6.1%	6.4%	7.3%	4.5%	2.5%	3.0%	4.7%	3.7%
Administration	4.3%	4.0%	3.1%	3.8%	3.8%	3.7%	3.8%	3.9%	4.1%	3.7%	3.9%	2.7%
Total net expenditure £M	136.8	153.3	175.5	201.4	216.7	234.8	254.3	277.9	298.5	316.7	357.5	365.5
1990 pounds (GDP deflator)	*377.5*	*382.2*	*374.6*	*363.3*	*356.0*	*359.7*	*372.3*	*387.5*	*395.1*	*405.2*	*434.4*	*414.6*

Definitions: Administration = headquarters costs

Expenditure = net of receipts;

Source: SERC Financial Statistics and Annual Reports

Table 3.2 Research Council expenditure on postgraduate training, as a proportion of total expenditure

	1977/78	1978/79	1979/80	1980/81	1981/82	1982/83	1983/84	1984/85	1985/86	1986/87	1987/88	1988/89
AFRC	0.5%	0.5%	0.5%	0.5%	0.5%	0.6%	0.5%	0.6%	0.7%	0.8%	0.9%	0.8%
ESRC	50.6%	53.3%	50.5%	42.7%	40.8%	38.3%	33.4%	33.6%	34.6%	33.8%	31.8%	28.6%
MRC	6.3%	6.3%	6.0%	5.6%	5.4%	5.5%	5.6%	5.7%	5.4%	5.1%	4.4%	4.3%
NERC	5.8%	6.0%	5.9%	5.6%	5.5%	6.0%	6.3%	6.1%	6.0%	6.0%	6.3%	5.3%
SERC	13.3%	14.1%	13.2%	13.6%	14.0%	13.4%	14.7%	14.9%	15.0%	14.8%	13.5%	13.7%
Total expenditure on postgraduate training £M (cash)	32.1	37.0	40.7	46.8	50.9	52.7	59.2	64.2	69.5	72.4	74.5	76.7
1990 pounds (GDP deflator)	*88.6*	*92.2*	*86.9*	*84.4*	*83.6*	*80.7*	*86.7*	*89.5*	*92.0*	*92.7*	*90.5*	*87.0*

Notes: Total excludes AFRC 1977/78 - 1979/80 inclusive

Definitions: Postgraduate training - AFRC; SERC; and ESRC up to 1984/85 inclusive; = studentships
ESRC after 1984/85; MRC; NERC; = studentships and fellowships

Table 3.3 Research council gross expenditure in own establishments and HEIs (£K, cash terms)

	1977/1978	1978/1979	1979/1980	1980/1981	1981/1982	1982/1983	1983/1984	1984/1985	1985/1986	1986/1987	1987/1988	1988/1989
AFRC own establishments	13,607	15,466	17,395	22,362	24,919	23,971	30,550	30,584	29,516	32,512	31,288	26,812
Grant-aided establishments	28,223	33,024	36,928	44,296	51,142	52,189	52,084	49,859	52,185	50,651	45,825	49,736
University Research Units	1,677	1,670	1,787	2,079	3,441	2,671	2,920	2,605	2,912	2,945	2,819	2,032
Universities/other HEIs	1,979	2,117	2,491	3,390	4,231	4,961	5,340	7,061	7,971	7,819	8,593	10,017
ESRC own establishments*												
University Research Units	595	632	729	966	1,118	1,175	1,310	931				
Universities/other HEIs	11,906	1,3637	14,664	17,277	17,362	17,160	18,729	18,578	20,080	20,896	22,237	23,084
MRC own establishments	10,776	1,3433	15,921	18,375	21,473	22,711	21,990	23,073	24,588	27,545	29,213	30,155
University Research Units	20,476	23,206	26,374	33,412	39,304	41,613	44,810	43,980	48,715	52,309	56,313	62,377
Universities/other HEIs	18,843	20,369	25,875	34,487	38,109	40,179	43,872	46,673	45,192	45,839	48,832	56,115
NERC own establishments	34,972	36,903	43,983	57,022	64,746	63,297	66,616	68,701	71,345	72,205	71,008	88,794
University Research Units	465	433	198	390	428	492	1,025	929	1,100	2,990	3,704	4,581
Research Vessel Services	3,842	4,484	4,366	5,347	6,701	7,170	5,662	6,527	6,582	8,485	8,765	9,248
Universities/other HEIs	5,093	5,460	6,682	8,089	8,964	9,604	10,332	9,914	10,656	10,994	11,837	11,539
SERC own establishments**	40,898	46,714	57,599	65,546	71,391	79,370	80,072	84,129	85,321	82,888	82,498	79,328
- Rutherford Appleton	27,352	29,139	35,129	42,171	43,386	49,320	52,284	55,904	56,615	54,119	61,176	53,264
- Daresbury	8,945	10,918	13,790	13,748	15,688	16,893	15,072	15,832	17,108	17,150	16,442	18,826
- RGO	1,995	3,297	4,980	6,059	8,253	8,862	8,136	7,754	6,889	5,995	5,732	5,882
- ROE	2,238	2,733	2,917	2,859	3,354	3,839	4,057	5,507	6,358	5,701	5,840	6,515
Universities/other HEIs	45,482	52,650	67,564	86,238	95,787	102,918	112,148	125,260	137,567	150,954	174,780	178,046

Sources: Annual Reports, AFRC and NERC appropriations offices, SERC financial statistics 1988, eighth edition

* ESRC does not have establishments similar to the other research councils.

** Figures for total own establishments are net of income from the Teaching Company (rising from £40K in 1977/78 to £5760K in 1988/89) and of any income from the Information Technology Directorate: they include income from the ACME and Biotechnology Directorates. Figures for RAL exclude administration (£1.4M in 1988/89).

Notes: figures for own establishments exclude headquarters expenditures and international subscriptions.

Table 3.3 Research council gross expenditure in own establishments and HEIs (£K, cash terms) (continued)

ESRC: in 1984/85 Research Units were converted to university research centres and from 1985/86 onwards expenditure cannot be extracted from University expenditure.

NERC: Research Units refers to the Unit of Comparative Plant Ecology until 1986/87, then to additional Units and University support.

NERC: split between own and university expenditure takes into account Grant-aided establishments and appropriate share of shared facilities,including those tabulated.

NERC: Own establishments includes all institutes (except Research Vessel Services), including those formerly classed as Grant-Aided Associations.

NERC: Research Vessel Services and other institute support for Higher Education was- 86/87:5722; 87/88:6533; 88/89:6789. Figures are unavailable for previous years.

SERC: own establishments figures include those tabulated for individual establishments.

University Research Units refers to Research Council funded units closely integrated with a university, providing university support.

Universities/other HEIs refers to postgraduate training, research grants and contracts placed with universities and other institutions.

Table 3.4 SERC Engineering Board expenditure (£K, cash terms)

	1977/1978	1978/1979	1979/1980	1980/1981	1981/1982	1982/1983	1983/1984	1984/1985	1985/1986	1986/1987	1987/1988	1988/1989
Engineering Board expenditure:												
Research grants	10,694	11,852	19,257	22,651	29,530	34,654	38,087	42,865	48,845	56,331	71,475	65,755
Postgraduate awards	6,906	7,781	8,528	10,862	12,129	13,013	17,911	21,438	23,578	24,780	25,466	25,885
Establishments	3,736	4,508	5,093	8,138	9,173	6,012	6,349	7,926	11,315	9,841	1,001	1,778
Other domestic facilities	95	146	212	383	632	725	648	442	665	1,048	955	1,849
Total (net) (including administration)	21,431	24,287	33,090	42,034	51,464	54,404	62,995	72,671	84,403	92,000	98,897	96,330
Breakdown of Engineering Board's Establishment expenditure												
Rutherford-Appleton	2,866	3,693	4,272	8,376	9,542	6,535	6,805	9,620	13,818	10,815	8,570	8,353
Atlas	809	863	768									
Biotechnology Directorate						76	108	94	66	78	-10	-5
Information Tech. Directorate							691	-202	-928	768	-3,659	-1,248
ACME Directorate								360	512	570	385	438
Marine Tech. Directorate	37	44	120	165	185	202	40	20	132	128		
Polymer Eng. Directorate	64	60	150	121	119	14	86	30				
Teaching Company	-40	-152	-217	-525	-673	-816	-1,381	-1,996	-2,284	-2,518	-4,285	-5,760
Total	3,736	4,508	5,093	8,138	9,173	6,012	6,349	7,926	11,315	9,841	1,001	1,778

Table 3.4 SERC Engineering Board expenditure (£K, cash terms) (continued)

	1977/1978	1978/1979	1979/1980	1980/1981	1981/1982	1982/1983	1983/1984	1984/1985	1985/1986	1986/1987	1987/1988	1988/1989
Breakdown of Engineering Board's Research Grant expenditure												
Computing science	794	833	1,109									
Chemical eng. and tech.	912	908	1,247									
Electrical and systems	1,621	1,580	2,838									
Control engineering	454	431	644									
Aeronautical and mech.	1,654	1,724	2,008									
Manufacturing tech.	811	759	1,277									
Civil and transport eng.	1,317	1,104	1,491									
Materials science and tech.	2,146	1,895	3,913									
Marine technology	448	1,171	2,841	3,971	5,407	5,196	5,263	5,087	4,608	3,690	3,155	1,430
Polymer engineering	246	411	752	1,348	1,583	1,509	1,590	1,223	1,247	1,309	1,346	
Energy	85	107	189	245	486	576	625	18				
Machines and power				3,250	4,199	4,681	4,962	5,044	4,769	5,874	6,216	5,332
Materials				3,894	4,388	4,762	4,795	4,416	4,567	5,126	5,608	5,064
Information engineering				4,346	6,135	8,818	10,032	13,509	19,160	22,778	29,726	26,099
Engineering processes*				2,539	3,496	3,629	3,895	4,675	4,492	6,832	10,423	9,910
Environment				1,624	2,165	2,530	2,654	3,486	3,652	3,880	4,656	5,391
Biotechnology						804	943	1,019	978	1,106	1,735	1,753
ESRC/SERC Joint Committee	-17	-37	-116	82	224	-3	52	314	212	151	105	133
Teaching Company	163	355	463	1,212	1,327	2,012	3,200	4,054	5,065	5,360	8,145	9,590
Materials Commission												715
Other	60	611	601	140	120	140	76	20	27	66	128	86
Total	10,694	11,852	19,257	22,651	29,530	34,654	38,087	42,865	48,777	56,172	71,243	65,503

* includes chemical engineering and production engineering /ACME

Table 3.5 SERC Science Board expenditure (£K, cash terms)

	1977/1978	1978/1979	1979/1980	1980/1981	1981/1982	1982/1983	1983/1984	1984/1985	1985/1986	1986/1987	1987/1988	1988/1989
Total SERC expenditure on universities/other HEIs *	45,482	52,650	67,564	86,238	95,787	102,918	112,148	125,260	137,567	150,954	174,780	178,046
1990 pounds GDP deflator	*125,513*	*131,254*	*144,217*	*155,544*	*157,355*	*157,685*	*164,165*	*174,683*	*182,087*	*193,243*	*212,359*	*201,944*
Science Board expenditure:												
Research grants	8,432	10,095	14,142	22,510	19,550	20,434	20,516	23,156	25,401	26,728	32,238	35,554
Postgraduate awards	10,878	12,560	13,806	16,745	18,400	18,962	19,849	20,853	22,682	23,632	25,017	25,466
Establishments	5,448	9,430	13,108	15,937	16,725	19,405	20,809	22,157	24,305	25,031	23,871	26,609
Other domestic facilities	1,093	1,350	1,328	1,349	1,063	1,180	927	409	419	948	911	315
International subscriptions	5,829	6,696	7,478	8,314	7,199	6,143	6,522	6,706	7,657	8,538	9,258	10,067
Total (net) (including administration)	31,680	40,131	49,862	64,855	62,937	66,124	68,623	73,281	80,464	84,877	91,295	99,638
1990 pounds GDP deflator	*87,424*	*100,045*	*106,431*	*116,976*	*103,391*	*101,312*	*100,452*	*102,195*	*106,504*	*108,655*	*110,924*	*113,012*
Breakdown of Science Board's Establishment expenditure												
Rutherford-Appleton	2,266	5,109	7,488	10,174	10,567	11,870	13,417	13,600	13,119	13,938	13,506	14,295
Daresbury	3,182	4,321	5,619	5,766	6,158	7,535	7,352	8,466	11,125	10,991	10,423	12,305
Total: all establishments (net)	5,448	9,430	13,108	15,937	16,725	19,405	20,809	22,157	24,305	25,031	23,871	26,609
1990 pounds GDP deflator	*15,034*	*23,509*	*27,979*	*28,745*	*27,475*	*29,731*	*30,461*	*30,899*	*32,171*	*32,043*	*29,003*	*30,181*
Breakdown of Science Board's Research Grant expenditure												
Biology	2,700	2,905	4,687	6,847	6,870	6,262	6,582	6,577	7,328	6,122	7,896	8,825
Chemistry	3,063	4,231	6,015	8,170	7,026	7,502	6,335	6,945	6,708	7,245	8,373	8,029
Maths	446	385	413	712	667	751	950	1,192	1,346	1,799	2,588	2,493
Other physics	2,036	2,194	2,424	5,900	4,158	4,126	4,134	5,202	5,906	7,063	7,436	6,012
Neutron beam	100	134	148	240	238	311	337	305	295	298	448	424
Science-Based archaeology	55	165	394	456	291	452	469	406	442	484	707	668

Table 3.5 SERC Science Board expenditure (£K, cash terms) (continued)

	1977/1978	1978/1979	1979/1980	1980/1981	1981/1982	1982/1983	1983/1984	1984/1985	1985/1986	1986/1987	1987/1988	1988/1989
Synchotron radiation				44	143	365	530	759	955	944	1,062	864
Laser				3	84	161	2009	367	297	351	430	392
Biotechnology						194	595	946	1,319	1,221	1,709	2,583
Other	32	81	61	133	73	310	375	457	805	1,201	1,589	3,142
IRCs												1,919
Materials Commission												203
Total	8,432	10,095	14,142	22,510	19,550	20,434	20,516	23,156	25,401	26,728	32,238	35,554
1990 pounds GDP deflator	*23,269*	*25,166*	*30,186*	*40,600*	*32,116*	*31,308*	*30,032*	*32,293*	*33,621*	*34,216*	*39,169*	*40,326*

* None of this money pays for services from/time in SERC establishments.

Research grants carry, where appropriate, an allocation of time to be spent in SERC establishments, paid for by the relevant Boards.

Table 3.6 Research Council expenditure on international subscriptions (£K, cash terms)

	1977/1978	1978/1979	1979/1980	1980/1981	1981/1982	1982/1983	1983/1984	1984/1985	1985/1986	1986/1987	1987/1988	1988/1989
MRC	1,331	1,434	1,480	1,417	1,538	1,825	2,137	2,519	2,557	3,129	3,359	3,359
1990 pounds (GDP deflator)	*3,672*	*3,575*	*3,158*	*2,556*	*2,526*	*2,797*	*3,128*	*3,513*	*3,385*	*4,005*	*4,081*	*3,810*
As % of total expenditure from all sources	2.4%	2.3%	2.0%	1.5%	1.4%	1.6%	1.8%	2.0%	2.0%	2.3%	2.2%	2.1%
SERC	41,691	45,299	43,062	41,519	40,850	43,328	52,156	56,986	63,260	70,663	86,937	90,429
1990 pounds (GDP deflator)	*115,051*	*112,928*	*91,917*	*74,886*	*67,107*	*66,385*	*76,347*	*79,471*	*83,733*	*90,459*	*105,629*	*102,567*
As % of total expenditure from all sources	29.8%	29.9%	23.8%	20.0%	18.2%	17.7%	19.7%	19.6%	20.0%	21.0%	22.5%	22.8%

Source: Annual Reports

Notes: Primary component of international subscriptions: MRC - European Molecular Biology Laboratory (EMBL);

SERC - European Organization for Nuclear Research (CERN)

Figures for total expenditure vary slightly from those for total receipts

Table 3.7 Universities' expenditure from general income on salaries and wages costs (£M, cash terms)

	1980/1981	1981/1982	1982/1983	1983/1984	1984/1985	1985/1986	1986/1987	1987/1988	1988/1989
Total recurrent expenditure (from general income)	1,349.5	1,458.9	1,578.5	1,659.5	1,779.6	1,876.0	1,976.0	2,147.5	2,347.6
Total pay expenditure	942.6	985.1	1,012.3	1,074.4	1,159.5	1,252.5	1,342.4	1,445.5	1,553.0
- as % of total recurrent expenditure	69.9%	67.5%	64.1%	64.7%	65.2%	66.8%	67.9%	67.3%	66.2%
Total non-pay expenditure	406.9	473.8	566.2	585.1	620.1	623.5	633.6	702.0	794.6
- as % of total recurrent expenditure	30.1%	32.5%	35.9%	35.3%	34.8%	33.2%	32.1%	32.7%	33.8%
Breakdown of salaries and wages costs:									
Academic non-clinical	473.3	496.2	508.3	538.4	576.1	627.6	674.8	735.8	790.9
Academic clinical	53.5	56.0	57.6	62.9	68.6	76.0	82.8	88.7	94.4
Total academic	526.8	552.2	565.9	601.4	644.7	703.5	757.7	824.5	885.3
- as % of total recurrent expenditure	39.0%	37.9%	35.9%	36.2%	36.2%	37.5%	38.3%	38.4%	37.7%
- as % of total pay expenditure	55.9%	56.1%	55.9%	56.0%	55.6%	56.2%	56.4%	57.0%	57.0%
Academic related	109.0	114.1	119.5	129.3	143.6	158.4	176.8	196.0	213.5
- as % of total recurrent expenditure	8.1%	7.8%	7.6%	7.8%	8.1%	8.4%	8.9%	9.1%	9.1%
- as % of total pay expenditure	11.6%	11.6%	11.8%	12.0%	12.4%	12.6%	13.2%	13.6%	13.7%
Technical	129.8	137.2	140.3	146.1	153.8	160.8	166.1	171.0	178.9
- as % of total recurrent expenditure	9.6%	9.4%	8.9%	8.8%	8.6%	8.6%	8.4%	8.0%	7.6%
- as % of total pay expenditure	13.6%	13.9%	13.9%	13.6%	13.3%	12.8%	12.4%	11.8%	11.5%
Secretarial and clerical	99.8	104.7	108.6	115.7	128.7	136.5	144.9	154.7	169.1
- as % of total recurrent expenditure	7.4%	7.2%	6.9%	7.0%	7.2%	7.3%	7.3%	7.2%	7.2%
- as % of total pay expenditure	10.6%	10.6%	10.7%	10.8%	11.1%	10.9%	10.8%	10.7%	10.9%

Source: Universities Statistical Record

Notes: total pay expenditure includes other salaries costs (approx. 6% total recurrent expenditure)

Table 3.8 Universities' departmental expenditure from general income on salaries and wages costs: for biochemistry, mechanical engineering, physics disciplines/cost centres (£M, cash terms)

	1980/1981	1981/1982	1982/1983	1983/1984	1984/1985	1985/1986	1986/1987	1987/1988	1988/1989
Biological sciences									
Total departmental recurrent expenditure	60.5	62.2	64.6	69.7					
Academic & acad. related salaries costs	33.5	35.0	36.3	39.2					
Biochemistry									
Total departmental recurrent expenditure					21.9	23.2	23.7	24.8	25.1
Academic & acad. related salaries costs					12.1	13.1	13.6	14.6	14.9
Academic & acad. related salaries costs as % departmental recurrent expenditure	55.3%	56.2%	56.1%	56.3%	55.2%	56.5%	57.4%	58.8%	59.5%
Engineering									
Total departmental recurrent expenditure	100.3	104.1	106.8	115.2					
Academic & acad. related salaries costs	61.8	64.6	65.8	70.8					
Mechanical, aero. and production engineering									
Total departmental recurrent expenditure					32.6	35.2	37.1	40.0	42.8
Academic & acad. related salaries costs					20.1	21.6	23.2	25.2	26.7
Academic & acad. related salaries costs as % departmental recurrent expenditure	61.6%	62.1%	61.6%	61.5%	61.6%	61.5%	62.5%	63.1%	62.4%
Physical sciences									
Total departmental recurrent expenditure	113.7	117.1	118.9	124.9					
Academic & acad. related salaries costs	66.6	69.0	69.6	73.3					
Physics									
Total departmental recurrent expenditure					52.9	56.4	59.6	62.1	63.5
Academic & acad. related salaries costs					31.3	33.8	36.3	38.6	39.9
Academic & acad. related salaries costs as % departmental recurrent expenditure	58.5%	58.9%	58.5%	58.7%	59.2%	59.8%	60.9%	62.2%	62.9%
All subjects combined									
Total departmental recurrent expenditure	760.3	789.5	812.8	866.8	928.0	1008.8	1081.5	1165.4	1257.2
Academic & acad. related salaries costs	536.6	561.9	574.3	611.4	649.7	709.0	769.0	838.0	900.8
as % departmental recurrent expenditure	70.6%	71.2%	70.7%	70.5%	70.0%	70.3%	71.1%	71.9%	71.7%

Source: Universities Statistical Record

Notes: From 1984/85 disciplines are recategorized into cost centres.

Table 3.9 Universities' expenditure from general income on academic and technical salaries and wages costs, all disciplines combined (£M, cash terms)

	1980/81	1981/82	1982/83	1983/84	1984/85	1985/86	1986/87	1987/88	1988/89
Salaries and wages costs									
- Academic	526.8	552.2	565.9	601.4	644.7	703.5	757.7	824.5	885.3
- Academic related	109.0	114.1	119.5	129.3	143.6	158.4	176.8	196.0	213.5
- Academic and academic related	635.8	666.3	685.5	730.7	788.3	861.9	934.5	1020.5	1098.8
- Technical	129.8	137.2	140.3	146.1	153.8	160.8	166.1	171.0	178.9
- Technical, as a % of academic and academic related	20.4%	20.6%	20.5%	20.0%	19.5%	18.7%	17.8%	16.8%	16.3%

Source : Universities Statistical Record

Table 3.10 Expenditure on support staff per FTE academic staff (£, cash terms)

	1984/1985	1985/1986	1986/1987	1987/1988	1988/1989
Cost centre:					
Biochemistry	11,140	11,140	12,000	13,600	15,000
1990 pounds (GDP deflator)	*15,535*	*14,745*	*15,362*	*16,524*	*17,013*
Mechanical, aero. and production engineering	10,000	10,700	10,900	13,200	14,700
1990 pounds (GDP deflator)	*13,946*	*14,163*	*13,954*	*16,038*	*16,673*
Physics	10,900	11,300	11,900	13,900	15,000
1990 pounds (GDP deflator)	*15,201*	*14,957*	*15,234*	*16,889*	*17,013*

Source: CVCP/UFC University Management Statistics and Performance Indicators

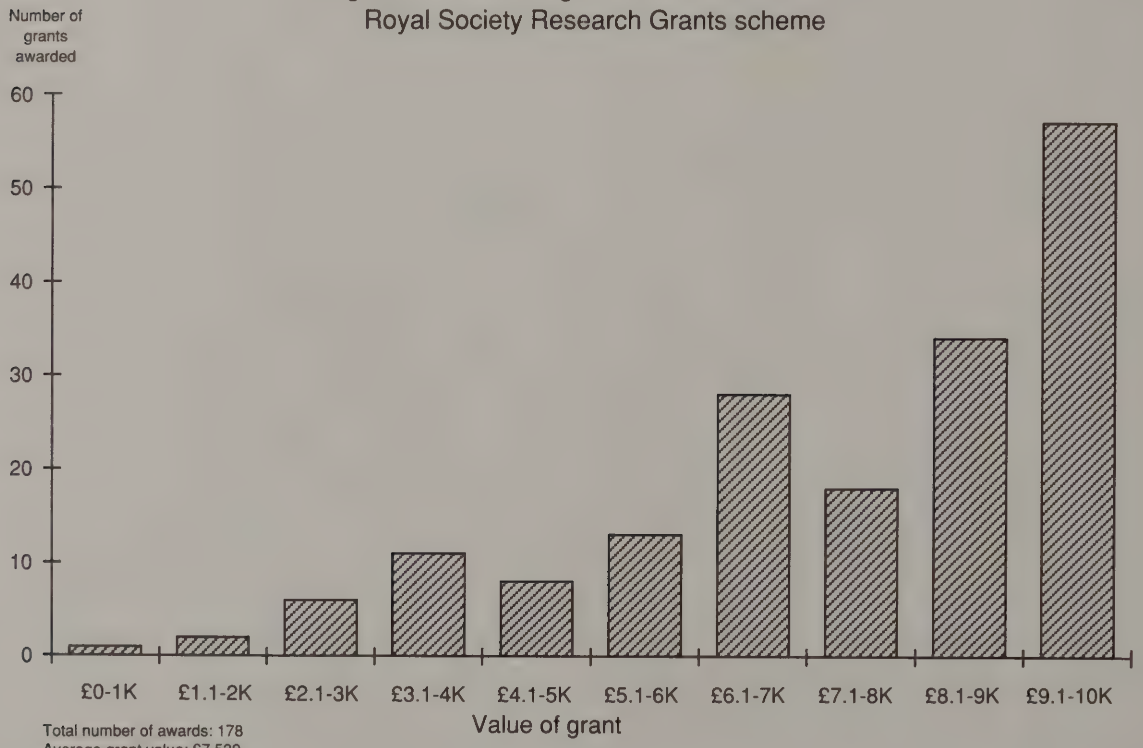
Definitions:

Support staff = technical, clerical and secretarial staff, for years 1984/85 to 1986/87

Year 1987/88: support staff = as above, PLUS departmental administrators, some laboratory supervisors and some research support staff on academic grades.

'FTE academic staff' covers all academic staff whose salary costs are borne wholly from general university funds and, pro rata, those partly covered by general university funds. It excludes externally funded staff (e.g. short term contract staff).

Figure 3.1 Value of grants awarded under the Royal Society Research Grants scheme



Total number of awards: 178
Average grant value: £7,539

Figure 4.1 Output of postgraduates from UK universities, both taught and research: a) engineering and technology

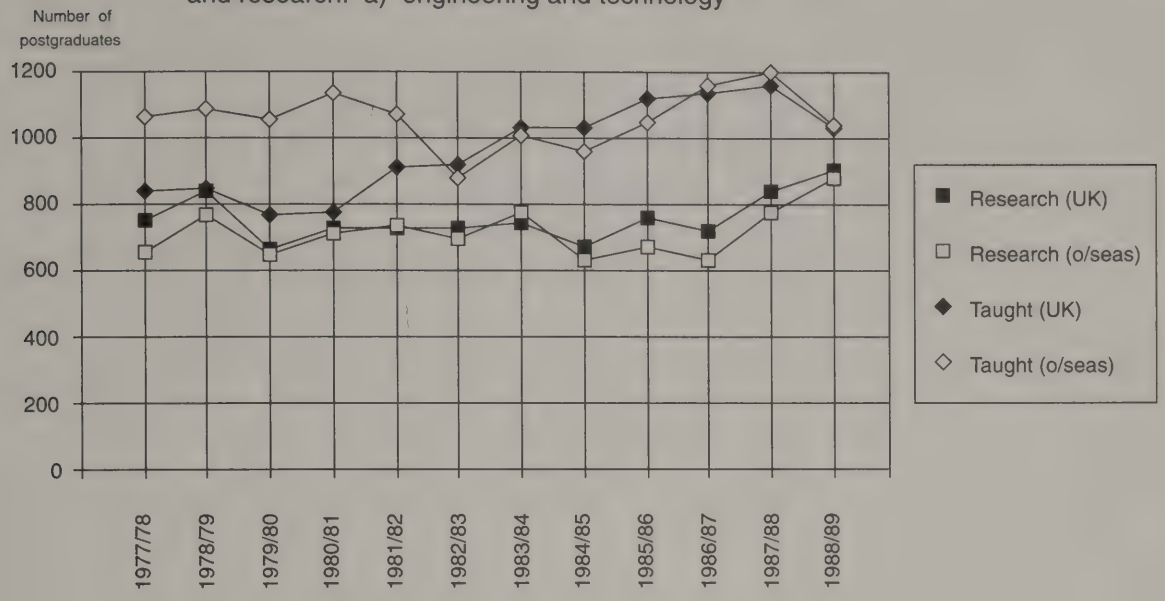


Fig 4.1 Output of postgraduates from UK universities, both taught and research: b) science

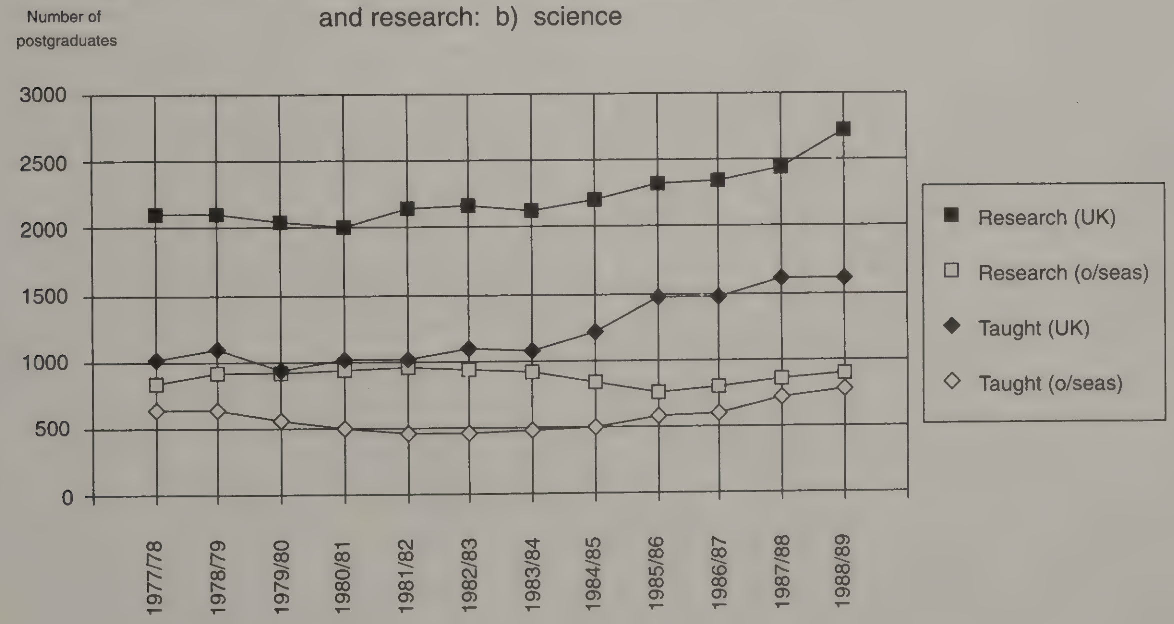


Figure 4.1 Output of postgraduates from UK universities, both taught and research: c) all subjects

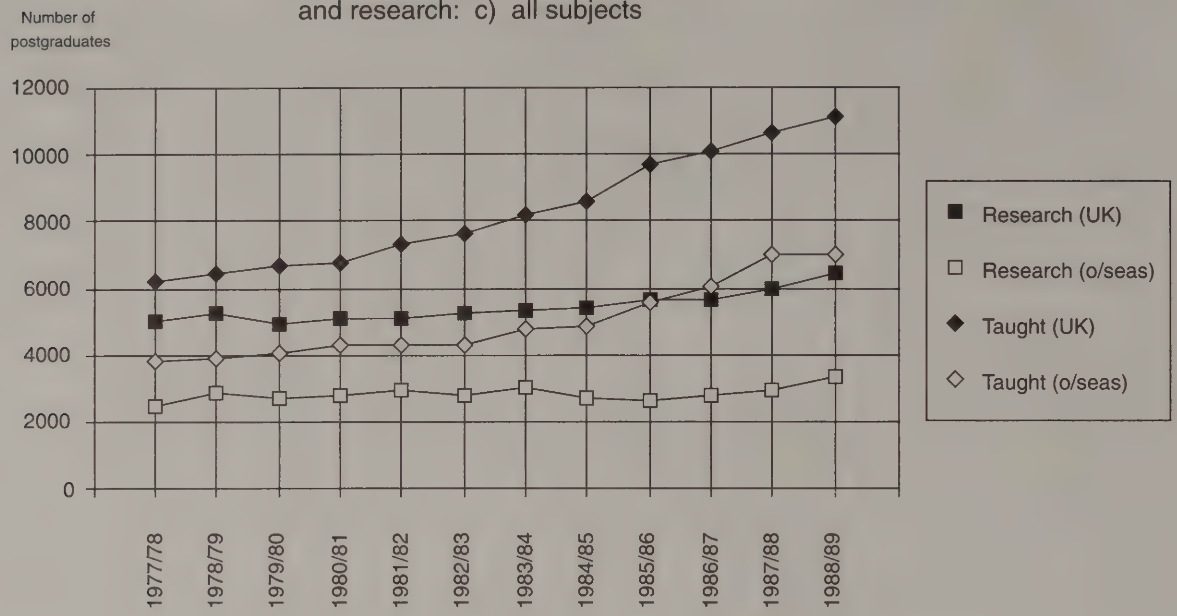


Table 4.1 Output of higher CNAA degrees

	1985			1986			1987			1988		
	Research		Taught	Research		Taught	Research		Taught	Research		Taught
	PhD	MPhil	MA/MSc	PhD	MPhil	MA/MSc	PhD	MPhil	MA/MSc	PhD	MPhil	MA/MSc
Engineering	54	34	114	61	31	203	73	39	240	87	31	282
Science	232	59	452	230	75	361	256	58	389	262	62	474
All disciplines	345	158	1,421	352	191	1,697	377	180	1,707	428	177	2,001

Source: CNAA Annual Reports

Table 4.2 Full time, clinical and non-clinical, academic (function 11+12) staff in UK universities by discipline and source of funding. All ages, all grades combined

	1977/1978			1978/1979			1979/1980			1980/1981			1981/1982		
	Wholly	Other	Total	Wholly	Other	Total	Wholly	Other	Total	Wholly	Other	Total	Wholly	Other	Total
E & T	4,107	1,186	5,293	4,152	1,236	5,388	4,235	1,419	5,654	4,258	1,600	5,858	4,182	1,767	5,949
Agric. & Vet	733	352	1,085	748	341	1,089	749	351	1,100	768	345	1,113	753	343	1,096
Biol. Sci.	2,198	977	3,175	2,160	1,054	3,214	2,172	1,154	3,326	2,139	1,232	3,371	2,140	1,299	3,439
Physical Sci.	4,140	1,170	5,310	4,155	1,244	5,399	4,139	1,432	5,571	4,086	1,625	5,711	3,996	1,653	5,649
Math & Comp	2,273	220	2,493	2,304	191	2,495	2,309	260	2,569	2,311	293	2,604	2,339	306	2,645
Science	8,611	2,367	10,978	8,619	2,489	11,108	8,620	2,846	11,466	8,536	3,150	11,686	8,475	3,258	11,733
All Subjects	32,986	7,568	40,554	33,695	8,172	41,867	34,250	9,108	43,358	34,297	9,795	44,092	33,735	10,189	43,924

	1982/1983			1983/1984			1984/1985			1985/1986			1986/1987		
	Wholly	Other	Total	Wholly	Other	Total	Wholly	Other	Total	Wholly	Other	Total	Wholly	Other	Total
E & T	3,884	1,950	5,834	3,873	2,157	6,030	3,945	2,313	6,258	4,087	2,482	6,569	4,174	2,755	6,929
Agric. & Vet	705	373	1,078	696	370	1,066	675	334	1,009	664	380	1,044	657	393	1,050
Biol. Sci.	2,007	1,433	3,440	1,989	1,496	3,485	2,231	1,689	3,920	2,243	1,770	4,013	2,231	1,895	4,126
Physical Sci.	3,699	1,779	5,478	3,569	1,800	5,396	3,482	1,776	5,258	3,513	1,840	5,353	3,482	1,989	5,471
Math & Comp	2,230	394	2,624	2,239	438	2,677	2,331	511	2,842	2,422	623	3,045	2,512	797	3,309
Science	7,936	3,606	11,542	7,824	3,734	11,558	8,044	3,976	12,020	8,178	4,233	12,411	8,225	4,681	12,906
All Subjects	31,642	11,441	43,083	31,096	12,053	43,149	31,043	13,167	44,210	31,412	14,331	45,743	31,432	15,606	47,038

Table 4.2 (Continued)
Full time, clinical and non-clinical, academic (function 11+12) staff in UK universities by discipline and source of funding. All ages, all grades combined.

	1987/1988			1988/1989			1989/90		
	Wholly	Other	Total	Wholly	Other	Total	Wholly	Other	Total
E & T	4,176	2,797	6,973	4,078	2,769	6,847	4,024	2,956	6,980
Agric. & Vet	654	417	1,071	654	484	1,138	641	523	1,164
Biol. Sci.	2,254	2,080	4,334	2,103	2,200	4,303	2,087	2,299	4,386
Physical Sci.	3,408	2,076	5,484	3,205	2,222	5,427	3,166	2,376	5,542
Math & Comp	2,519	832	3,351	2,504	836	3,340	2,526	935	3,461
Science	8,181	4,988	13,169	7,812	5,258	13,070	7,779	5,610	13,389
All Subjects	31,259	16,415	47,674	30,621	17,436	48,057	31,340	18,050	49,390

Source: University Statistical Record (unpublished)

Definitions:

Engineering and Technology: subject category 3; cost centres 19-25, 27

Agriculture and veterinary science: subject category 4; cost centres 12,13

Biological science: biology & botany & zoology & physiology/anatomy & biochemistry & other general & combined from within subject category 5;, cost centres 9, 11

Physical sciences: subject category 5 minus biological science and mathematics; cost centress 14,15 16

Mathematics and computing: mathematics from within subject category 5; cost centres 17, 18

Science: biological science & physical science & mathematics/computing

Notes:

Wholly: financed wholly from general university funds

Other: financed partly or wholly from other funds

Year: 1977/78 refer to staff in post on 31 December 1977

On discontinuities in 1984/85, see text (section IV (i))

Table 4.3 Proportion of academic staff in UK universities holding Ph.Ds.

(i) Long-term staff

	All Ages				Under 30 years old			
	77/78	81/82	84/85	88/89	77/78	81/82	84/85	88/89
E & T	51.8%	53.4%	56.8%	58.8%	29.1%	24.7%	24.1%	25.5%
Agric. & Vet	50.8%	53.4%	54.7%	57.2%	20.9%	18.8%	26.0%	14.5%
Biol. Sci.	76.5%	77.7%	82.6%	83.9%	57.6%	46.6%	56.8%	34.4%
Physical Sci.	76.5%	77.7%	83.3%	85.1%	38.4%	47.3%	50.2%	63.0%
Math & Comp	57.9%	59.0%	60.5%	59.5%	29.9%	35.0%	33.3%	29.1%
All Science	71.6%	72.6%	76.5%	76.5%	41.8%	43.5%	46.0%	41.5%
All Subjects	43.9%	45.5%	48.8%	51.2%	21.9%	20.5%	25.2%	24.0%

(ii) Short-term staff

	All Ages				Under 30 years old			
	77/78	81/82	84/85	88/89	77/78	81/82	84/85	88/89
E & T	25.5%	24.6%	18.9%	21.8%	18.2%	13.5%	8.5%	10.6%
Agric. & Vet	34.1%	32.7%	38.0%	40.7%	21.3%	17.9%	22.2%	18.5%
Biol. Sci.	34.3%	36.2%	31.7%	37.7%	25.4%	24.4%	20.8%	25.6%
Physical Sci.	42.9%	38.7%	40.8%	42.2%	34.2%	28.1%	31.1%	32.4%
Math & Comp	36.8%	29.1%	26.4%	25.0%	31.1%	22.2%	17.8%	13.6%
All Science	38.8%	36.8%	35.1%	37.6%	30.0%	26.0%	24.8%	26.4%
All Subjects	27.8%	27.6%	26.6%	28.5%	20.9%	19.7%	17.6%	18.8%

Table 4.4 Part-time academic staff

	1977/78	1978/79	1979/80	1980/81	1981/82	1982/83	1983/84	1984/85	1985/86	1986/87	1987/88	1988/89
Number	1,510	1,521	1,587	1,678	1,738	2,371	2,865	3,495	3,244	3,243	3,162	3,621
% research only	26.1	n/a	n/a	n/a	n/a	27.3	25.1	23.5	28.2	31.7	34.9	33.1

Source : University Statistics 1988-1989: students and staff (USR): table 28

Table 4.5 Research council staff

	1977/78	1978/79	1979/80	1980/81	1981/82	1982/83	1983/84	1984/85	1985/86	1986/87	1987/88	1988/89
AFRC Number of staff	7,264	7,133	6,882	6,692	6,796	6,761	6,525	6,366	5,781	5,276	3,737	3,639
ESRC Number of staff	218	208	236	239	209	201	201	142	105	112	112	109
MRC Number of staff	3,976	4,019	3,974	4,051	4,033	3,937	4,000	3,946	n/a	3,865	3,890	3,871
NERC Number of staff	3,151	3,070	3,185	3,424	3,165	3,191	2,765	2,758	2,541	2,765	2,711	2,678
SERC Number of staff	2,750	2,785	2,949	2,940	2,898	2,911	2,876	2,708	2,712	2,786	2,716	2,705

Sources: Research Council Annual Reports

Definitions: Number of staff = number of staff in post

Notes: NERC figures exclude headquarters staff up to 1979/80 inclusive, and exclude ships crews (approximately 130) in 1983/84

AFRC : permanent staff only

MRC : full-time plus part-time

Figure 4.2 (i) Age profile of academic staff: engineering and technology, wholly university funded

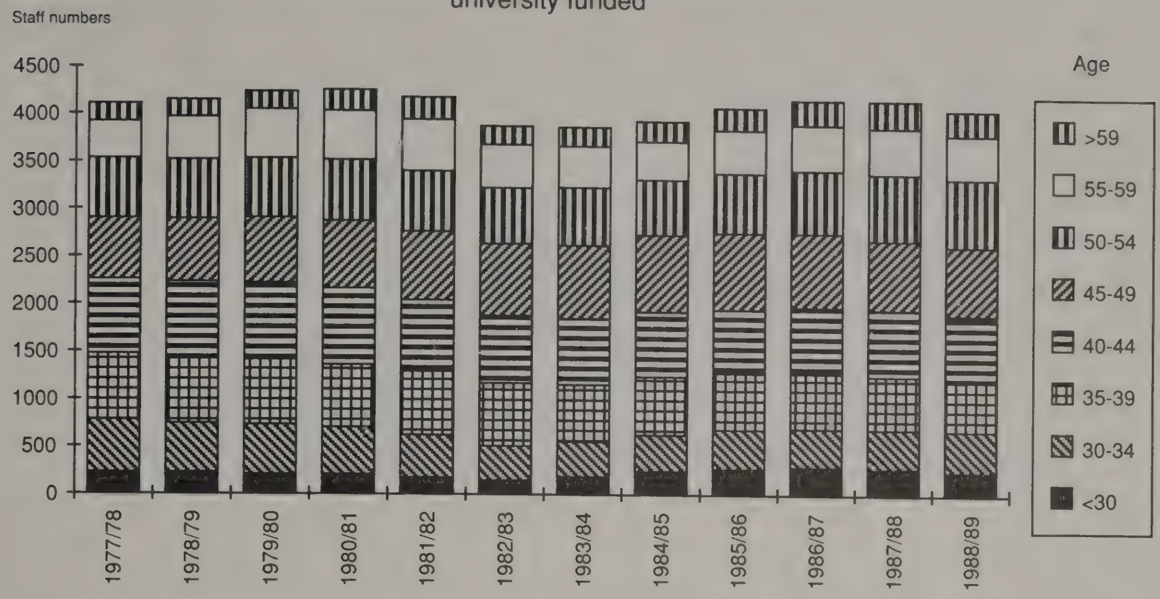


Figure 4.2 (ii) Age profile of academic staff: science, wholly university funded

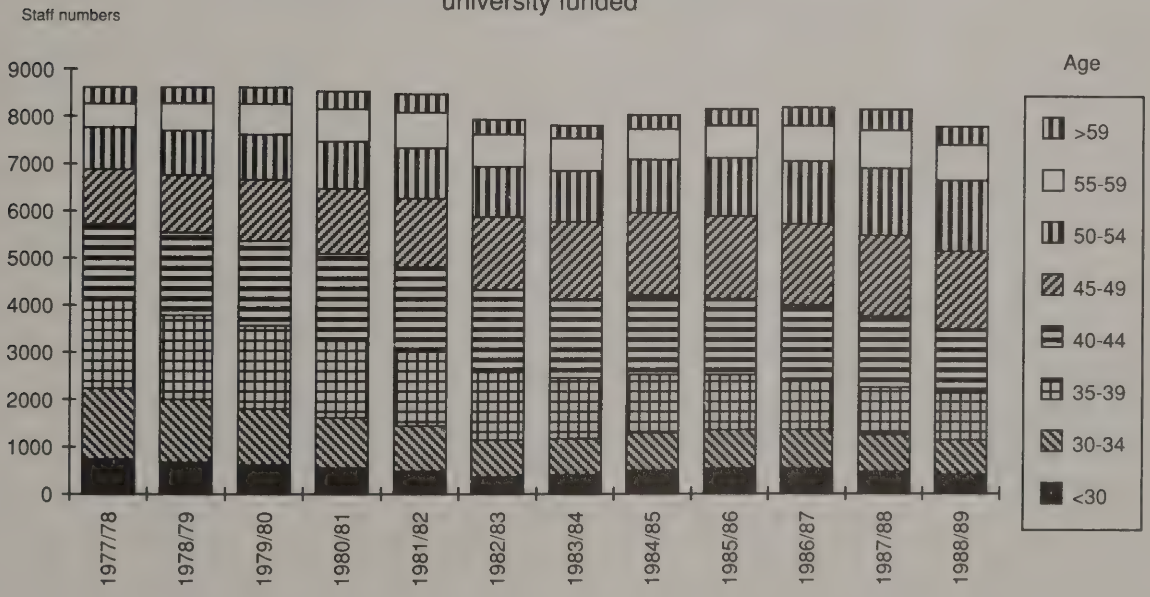


Figure 4.2 (iii) Age profile of academic staff: all disciplines, wholly university funded

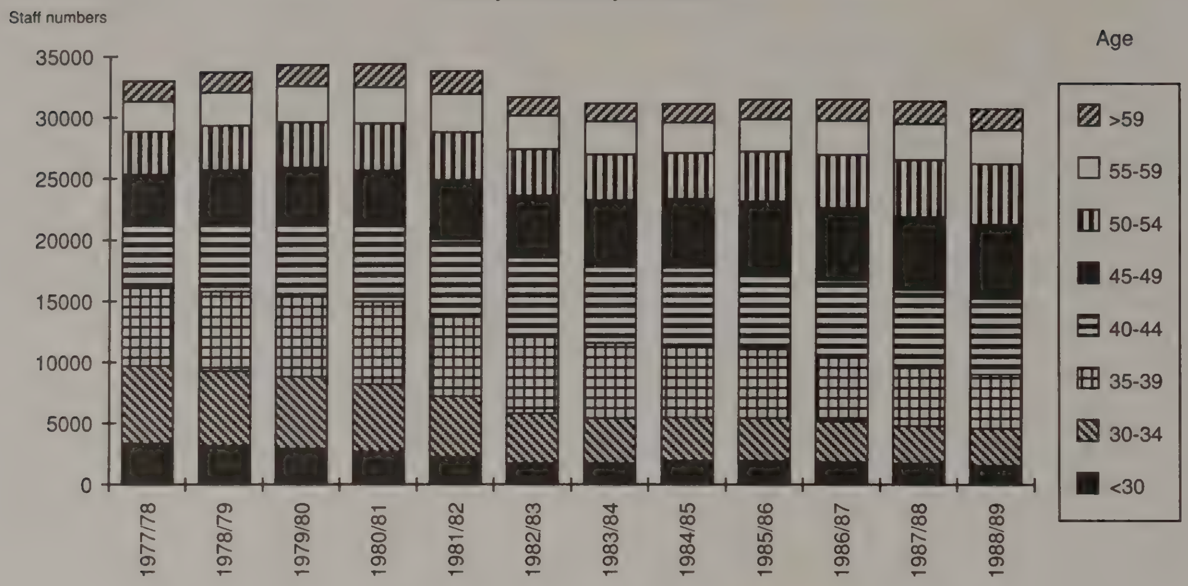


Figure 4.2 (iv) Age profile of academic staff: engineering and technology, not university funded

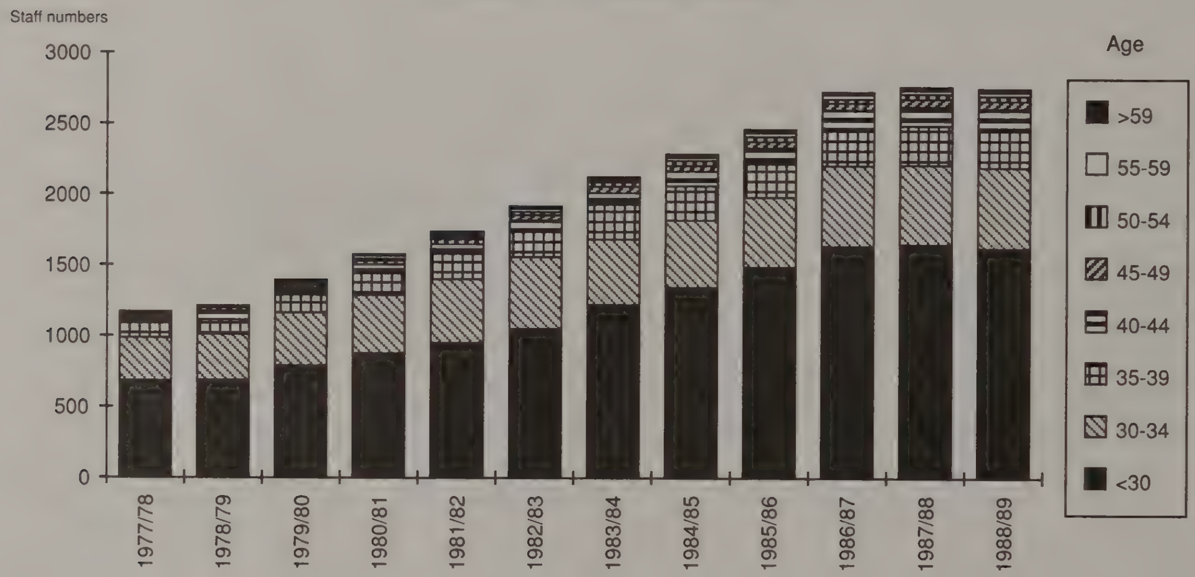


Figure 4.2(v) Age profile of academic staff: science, not university funded

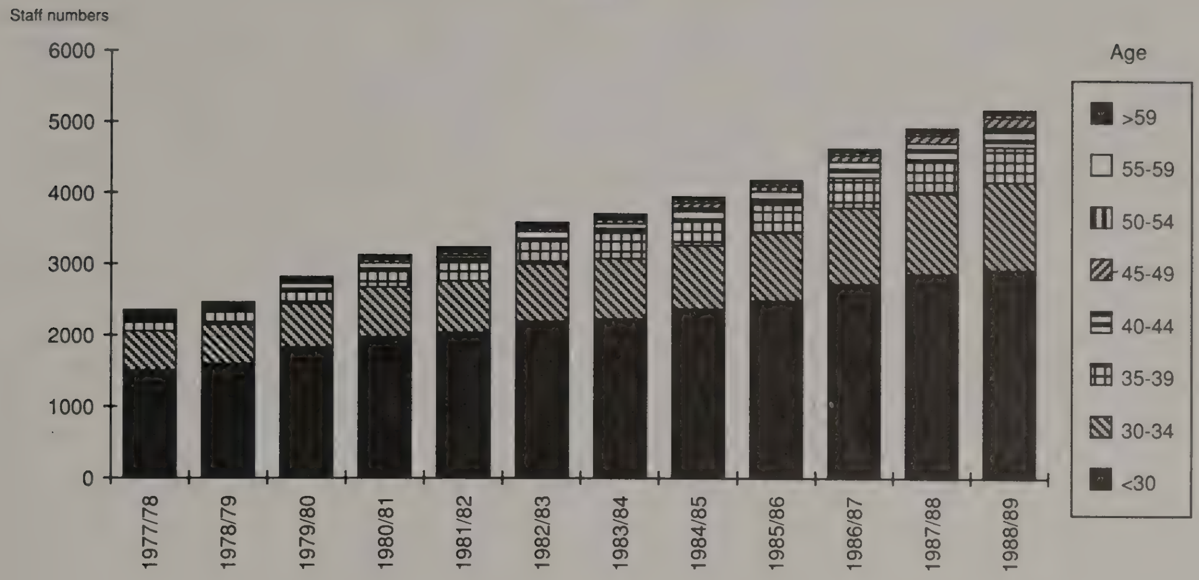


Figure 4.2 (vi) Age profile of academic staff: all disciplines, not university funded

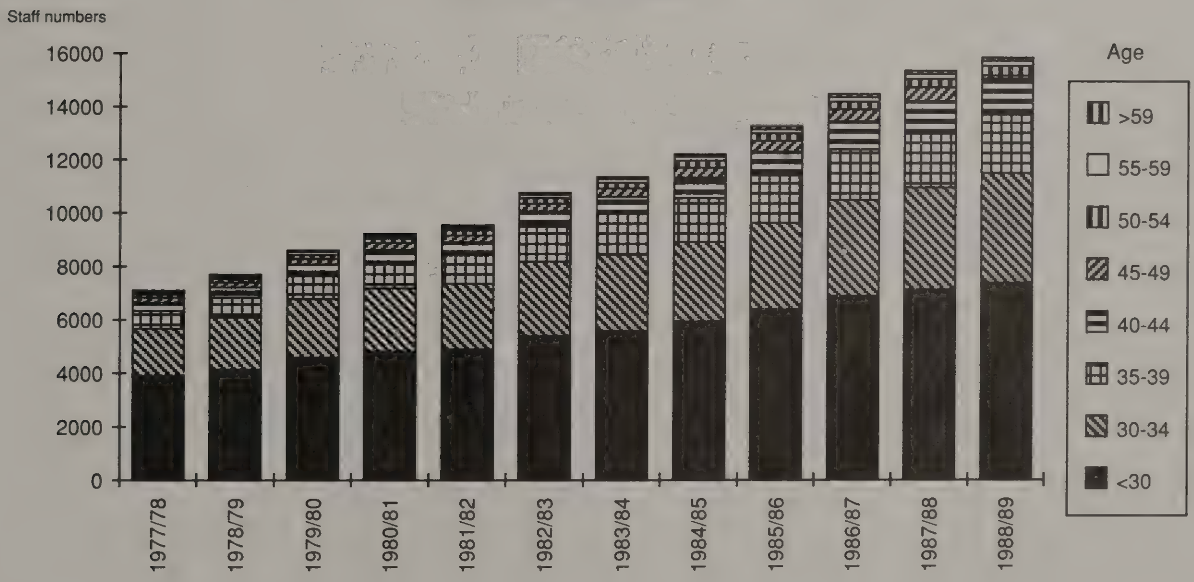


Table 4.6 (a) Previous employment of full-time, clinical and non-clinical, academic staff: All ages, all grades combined. Wholly university funded.

	1977/1978				1978/1979				1979/1980				1980/1981			
	Non Univ	Overseas	UK Student	Total	Non Univ	Overseas	UK Student	Total	Non Univ	Overseas	UK Student	Total	Non Univ	Overseas	UK Student	Total
E & T	4	16	29	115	21	22	39	167	17	24	38	168	18	31	39	168
Agric. & Vet	8	11	16	48	2	6	28	51	3	10	20	59	3	5	20	50
Biol. Sci.	3	18	25	74	3	15	28	72	6	17	26	76	2	20	22	74
Physical Sci.	7	29	58	129	5	40	72	167	5	44	64	163	4	39	44	114
Math & Comp	10	18	21	58	2	11	30	65	9	25	36	94	9	15	23	68
All Science	20	65	104	261	10	66	130	304	20	86	126	333	15	74	89	256
All Subjects	267	306	440	1748	330	349	543	2,180	234	362	504	2019	150	311	358	1,627

	1981/1982				1982/1983				1983/1984				1984/1985			
	Non Univ	Overseas	UK Student	Total	Non Univ	Overseas	UK Student	Total	Non Univ	Overseas	UK Student	Total	Non Univ	Overseas	UK Student	Total
E & T	19	14	36	119	9	8	27	73	9	16	43	163	125	20	50	306
Agric. & Vet	0	4	13	28	0	2	14	34	1	8	24	48	3	9	16	61
Biol. Sci.	1	6	26	52	1	2	6	27	1	18	10	54	25	21	21	109
Physical Sci.	4	24	24	87	0	11	24	50	1	33	48	129	20	51	40	160
Math & Comp	4	9	25	68	1	7	18	35	4	18	27	80	53	42	39	176
All Science	9	39	75	207	2	20	48	112	6	69	85	263	98	114	100	445
All Subjects	127	210	267	1,228	41	135	181	853	76	254	316	1,409	677	294	349	2,263

	1985/1986				1986/1987				1987/1988				1988/1989			
	Non Univ	Overseas	UK Student	Total	Non Univ	Overseas	UK Student	Total	Non Univ	Overseas	UK Student	Total	Non Univ	Overseas	UK Student	Total
E & T	20	19	62	119	27	22	60	190	20	16	32	149	23	13	40	159
Agric. & Vet	1	7	21	53	2	6	13	41	0	4	21	42	3	9	12	51
Biol. Sci.	0	19	17	77	2	10	18	59	1	7	16	55	2	11	12	48
Physical Sci.	6	45	44	143	4	34	24	100	3	15	31	80	1	26	19	69
Math & Comp	25	25	55	155	17	29	63	155	11	23	25	110	15	21	36	101
All Science	31	89	116	375	23	73	105	314	15	45	72	245	18	58	67	218
All Subjects	161	334	366	1,692	149	287	334	1,489	170	234	287	1,379	207	269	300	1,706

Table 4.6 (a) Previous employment of full-time, clinical and non-clinical, academic staff: All ages, all grades combined.

Source: Universities Statistical Record (unpublished)

Definitions:

Previous employment: USR records at 31 December each year the occupation of all academic staff as at the same time the previous year.
The present table excludes staff whose previous employment was at the same university, or at another university in the UK.

Non Univ: Educational institutions in the UK other than universities (mainly polytechnics).

Overseas: Includes overseas universities, other overseas employment and those previously students overseas.

UK students: Full-time students in UK.

Total : Includes a considerable number of other 'previous employments'.

Disciplines: see table 4.2

Notes:

The impact of the merger of Ulster Polytechnic with Coleraine University is particularly evident in the large number of staff in 1984/85 whose previous employment was non-university education in the UK.

Table 4.6 (b) Previous employment of full-time, clinical and non-clinical, academic staff:All ages, all grades combined. Partially and not university funded.

	1977/1978				1978/1979				1979/1980				1980/1981			
	Non Univ	Overseas	UK Student	Total	Non Univ	Overseas	UK Student	Total	Non Univ	Overseas	UK Student	Total	Non Univ	Overseas	UK Student	Total
E & T	12	39	191	355	9	59	251	457	18	84	261	541	14	72	259	548
Agric. & Vet	1	14	36	67	1	8	27	70	3	9	34	76	0	9	40	68
Biol. Sci.	4	35	169	298	12	45	227	380	5	49	236	402	8	46	215	367
Physical Sci.	3	87	225	390	9	145	271	533	11	188	275	570	12	158	308	599
Math & Comp	0	21	33	54	2	12	41	70	6	24	53	123	3	27	45	100
All Science	7	143	427	742	23	202	539	983	22	261	564	1,095	23	231	568	1,066
All Subjects	55	283	1,020	2,091	99	392	1,296	2,782	104	511	1,298	3,056	95	422	1,309	2,930

	1981/1982				1982/1983				1983/1984				1984/1985			
	Non Univ	Overseas	UK Student	Total	Non Univ	Overseas	UK Student	Total	Non Univ	Overseas	UK Student	Total	Non Univ	Overseas	UK Student	Total
E & T	16	61	298	561	13	68	332	691	17	83	420	781	19	88	384	826
Agric. & Vet	0	5	34	67	1	4	47	96	2	5	31	73	2	3	44	90
Biol. Sci.	6	47	201	365	7	38	225	461	4	71	280	484	8	62	267	544
Physical Sci.	5	120	310	536	11	120	319	690	15	155	318	627	12	131	292	621
Math & Comp	8	17	53	101	2	22	82	181	7	34	75	161	6	32	100	191
All Science	19	184	564	1,002	20	180	626	1,332	26	260	673	1,272	26	225	659	1,356
All Subjects	76	371	1,249	2,735	78	353	1,473	3,668	113	503	1,602	3,644	126	461	1,539	4,032

	1985/1986				1986/1987				1987/1988				1988/1989			
	Non Univ	Overseas	UK Student	Total	Non Univ	Overseas	UK Student	Total	Non Univ	Overseas	UK Student	Total	Non Univ	Overseas	UK Student	Total
E & T	33	87	507	921	22	121	508	991	21	75	436	851	19	82	423	830
Agric. & Vet	1	7	57	104	3	11	37	87	0	14	48	114	2	15	45	128
Biol. Sci.	15	66	283	545	15	84	310	619	4	92	335	670	20	95	352	671
Physical Sci.	17	132	343	629	19	198	353	720	8	195	343	699	15	211	408	801
Math & Comp	12	52	137	266	19	75	172	340	11	54	141	258	15	38	113	223
All Science	44	250	763	1,440	53	357	835	1,679	23	341	819	1,627	50	344	873	1,695
All Subjects	147	560	1,897	4,512	169	678	1,951	4,812	123	643	1,888	4,780	165	687	1,951	5,020

Table 4.6 (c) Previous employment of full-time, clinical and non-clinical, academic staff: All ages, all grades combined. All sources of funding.

	1977/1978				1978/1979				1979/1980				1980/1981			
	Non Univ	Overseas	UK Student	Total	Non Univ	Overseas	UK Student	Total	Non Univ	Overseas	UK Student	Total	Non Univ	Overseas	UK Student	Total
E & T	16	55	221	470	30	81	290	624	35	108	299	709	32	103	298	716
Agric. & Vet	9	26	52	115	3	14	55	121	6	19	54	135	3	14	60	118
Biol. Sci.	7	53	194	372	15	60	255	462	11	66	262	478	10	67	237	441
Physical Sci.	10	117	283	519	14	185	343	690	16	232	339	733	16	197	352	713
Math & Comp	10	39	54	112	4	23	71	135	15	49	89	217	12	42	68	168
All Science	27	209	531	1,003	33	268	669	1,287	42	347	690	1,428	38	306	657	1,322
All Subjects	322	589	1,460	3,839	429	741	1,839	4,962	338	880	1,802	5,075	245	733	1,667	4,557

	1981/1982				1982/1983				1983/1984				1984/1985			
	Non Univ	Overseas	UK Student	Total	Non Univ	Overseas	UK Student	Total	Non Univ	Overseas	UK Student	Total	Non Univ	Overseas	UK Student	Total
E & T	35	75	334	680	22	76	359	758	26	99	463	944	144	98	434	1132
Agric. & Vet	0	9	47	95	1	6	61	130	3	13	55	121	5	12	60	151
Biol. Sci.	7	53	227	417	8	40	231	488	5	89	290	538	33	83	288	653
Physical Sci.	12	144	335	623	11	131	343	743	16	188	366	756	32	182	332	781
Math & Comp	9	26	78	169	3	29	100	216	11	52	102	241	59	74	139	367
All Science	28	223	640	1,209	22	200	674	1,447	32	329	758	1,535	124	339	759	1801
All Subjects	204	581	1,518	3,963	119	489	1,654	4,521	189	757	1,920	5,053	803	755	1,888	6,295

	1985/1986				1986/1987				1987/1988				1988/1989			
	Non Univ	Overseas	UK Student	Total	Non Univ	Overseas	UK Student	Total	Non Univ	Overseas	UK Student	Total	Non Univ	Overseas	UK Student	Total
E & T	53	106	569	1,120	49	143	568	1,181	41	91	468	1,000	42	95	463	987
Agric. & Vet	2	15	78	157	5	17	50	128	0	18	69	156	5	24	57	179
Biol. Sci.	15	85	300	622	17	94	328	678	5	99	351	725	22	106	364	719
Physical Sci.	23	177	387	772	23	232	377	820	11	210	374	779	16	237	427	870
Math & Comp	37	77	192	421	36	104	235	495	22	77	166	368	30	59	149	327
All Science	75	339	879	1,815	76	430	940	1,993	38	386	891	1,872	68	372	940	1,916
All Subjects	308	894	2,263	6,204	318	965	2,285	6,301	293	877	2,175	6,159	372	956	2,251	6,726

Table 4.7 Full-time, clinical and non-clinical, academic (function 11 + 12) staff who were wholly university funded in year X and partly or not university funded in year (X-1). All grades combined.

	1977/78			1978/79			1979/80			1980/81		
	Total	% of staff in short-term posts	% of staff already in long-term posts	Total	% of staff in short-term posts	% of staff already in long-term posts	Total	% of staff in short-term posts	% of staff already in long-term posts	Total	% of staff in short-term posts	% of staff already in long-term posts
E & T	53	4.4	1.3	64	5.4	1.5	64	5.2	1.5	40	2.8	0.9
Agric. & Vet	7	2.0	1.0	15	4.3	2.0	10	2.9	1.3	10	2.8	1.3
Biol. Sci.	18	1.8	0.8	23	2.4	1.1	27	2.6	1.2	15	1.3	0.7
Physical Sci.	25	2.2	0.6	45	3.8	1.1	43	3.5	1.0	39	2.7	1.0
Math & Comp	16	6.6	0.7	32	14.5	1.4	16	8.4	0.7	17	6.5	0.7
All Science	59	2.5	0.7	100	4.2	1.2	86	3.5	1.0	71	2.5	0.8
All Subjects	319	4.2	1.0	341	4.5	1.0	402	4.9	1.2	289	3.2	0.8

	1981/82			1982/83			1983/84			1984/85		
	Total	% of staff in short-term posts	% of staff already in long-term posts	Total	% of staff in short-term posts	% of staff already in long-term posts	Total	% of staff in short-term posts	% of staff already in long-term posts	Total	% of staff in short-term posts	% of staff already in long-term posts
E & T	43	2.7	1.0	28	1.6	0.7	79	4.1	2.0	92	4.3	2.3
Agric. & Vet	13	3.8	1.7	6	1.7	0.9	15	4.0	2.2	19	5.1	2.8
Biol. Sci.	18	1.5	0.8	16	1.2	0.8	42	2.9	2.1	63	4.2	2.8
Physical Sci.	35	2.2	0.9	30	1.8	0.8	61	3.4	1.7	92	5.1	2.6
Math & Comp	23	7.8	1.0	12	3.9	0.5	43	10.9	1.9	40	9.1	1.7
All Science	76	2.4	0.9	58	1.8	0.7	146	4.0	1.9	195	5.2	2.4
All Subjects	305	3.1	0.9	194	1.9	0.6	435	3.8	1.4	576	4.8	1.9

Table 4.7 Full-time, clinical and non-clinical, academic (function 11 + 12) staff who were wholly university funded in year X and partly or not university funded in year (X-1). All grades combined. (continued)

	1985/86			1986/87			1987/88			1988/89		
	Total	% of staff in short-term posts	% of staff already in long-term posts	Total	% of staff in short-term posts	% of staff already in long-term posts	Total	% of staff in short-term posts	% of staff already in long-term posts	Total	% of staff in short-term posts	% of staff already in long-term posts
E & T	88	3.8	2.2	89	3.6	2.1	101	3.7	2.4	95	3.4	2.3
Agric. & Vet	11	3.3	1.7	7	1.8	1.1	16	4.1	2.5	8	1.9	1.2
Biol. Sci.	48	2.8	2.1	31	1.8	1.4	30	1.6	1.3	32	1.5	1.5
Physical Sci.	64	3.6	1.8	45	2.4	1.3	45	2.3	1.3	49	2.4	1.5
Math & Comp	51	10.0	2.1	63	10.1	2.5	45	5.6	1.8	69	8.3	2.8
All Science	163	4.1	2.0	139	3.3	1.7	120	2.6	1.5	150	3.0	1.9
All Subjects	525	4.0	1.7	459	3.2	1.5	598	3.8	1.9	540	3.3	1.8

Source: University Statistical Record (unpublished)

Definitions:
Engineering and technology: subject category 3; cost centre group 7.
Agriculture and veterinary science: subject category 4; cost centre group 4.
Biological science: biology & botany & zoology & physiology/anatomy & biochemistry & other general & combined from within subject category 5; cost centre group 3.
Physical science: subject category 5 minus biological science and mathematics; cost centre group 5.
Mathematics & computing: mathematics from within subject category 5; cost centre group 6.
Science: subject category 5; cost centre groups 3,5,6.

Notes: year 1977/78 refers to staff in post on 31 December 1977
Percentages are calculated with respect to the total number of short-term staff in the year (X-1) and the total number of long-term staff in the year X.

Table 4.8 (a) Destination, on leaving, of full-time clinical and non-clinical academic staff, by source of funding. All ages, all grades combined. Wholly university funded.

	1977/78						1978/79						1979/80					
	Transfer	Overseas	Industry	Retired	Other	Total	Transfer	Overseas	Industry	Retired	Other	Total	Transfer	Overseas	Industry	Retired	Other	Total
E & T	27	37	24	40	22	178	27	34	17	44	21	165	28	22	18	44	32	173
Agric. & Vet	9	5	8	10	12	56	5	9	11	7	2	49	9	9	7	13	13	61
Biol. Sci.	14	18	5	15	13	87	25	13	8	16	17	99	33	14	10	18	12	103
Physical Sci.	32	42	24	39	32	209	32	48	25	31	31	199	25	23	31	32	40	182
Math & Comp	20	22	8	9	19	93	24	18	5	16	6	81	26	18	12	17	15	105
All Science	66	82	37	63	64	389	81	79	38	63	54	379	84	55	53	67	67	390
All Subjects	377	381	110	310	304	2,007	428	376	107	346	281	2,033	494	304	119	339	340	2,064

	1980/81						1981/82						1982/83					
	Transfer	Overseas	Industry	Retired	Other	Total	Transfer	Overseas	Industry	Retired	Other	Total	Transfer	Overseas	Industry	Retired	Other	Total
E & T	32	24	14	75	23	198	33	31	18	91	27	221	27	22	18	287	27	402
Agric. & Vet	9	3	5	13	13	54	5	9	9	10	10	59	3	4	17	45	14	87
Biol. Sci.	17	13	3	18	16	80	22	6	4	31	19	99	12	5	7	85	19	135
Physical Sci.	27	29	24	43	41	200	22	18	15	56	51	182	19	30	15	200	41	329
Math & Comp	23	19	5	20	13	95	18	15	3	25	9	79	16	13	5	100	16	162
All Science	67	61	32	81	70	375	62	39	22	112	79	360	47	48	27	385	76	626
All Subjects	411	290	80	425	369	2,026	328	242	76	529	365	1,974	330	250	104	1,533	402	3,019

	1983/84						1984/85						1985/86					
	Transfer	Overseas	Industry	Retired	Other	Total	Transfer	Overseas	Industry	Retired	Other	Total	Transfer	Overseas	Industry	Retired	Other	Total
E & T	25	19	12	147	36	264	26	10	13	21	52	219	48	12	23	38	49	190
Agric. & Vet	5	2	11	30	14	72	6	5	10	4	10	50	2	3	15	9	7	43
Biol. Sci.	19	7	5	58	13	113	31	2	5	3	24	104	17	7	5	18	25	89
Physical Sci.	30	17	16	140	46	253	54	15	21	22	35	223	48	14	13	16	44	153
Math & Comp	24	7	7	59	15	132	63	15	9	11	28	167	37	24	11	15	38	133
All Science	73	31	28	257	64	498	148	32	35	36	87	494	102	45	29	49	107	378
All Subjects	395	202	76	954	374	2,408	382	167	85	173	445	2,082	388	181	88	268	494	1,752

Table 4.8 (a) (Continued) Destination, on leaving, of full-time clinical and non-clinical academic staff, by source of funding. All ages, all grades combined. Wholly university funded.

	1986/87						1987/88						1988/89					
	Transfer	Overseas	Industry	Retired	Other	Total	Transfer	Overseas	Industry	Retired	Other	Total	Transfer	Overseas	Industry	Retired	Other	Total
E & T	33	21	24	55	42	193	28	14	32	64	43	210	30	11	14	141	43	264
Agric. & Vet	2	3	13	7	15	49	2	1	12	9	9	47	6	3	12	11	9	49
Biol. Sci.	9	7	8	20	23	82	12	7	6	23	31	86	11	5	6	81	28	141
Physical Sci.	28	15	14	39	28	146	19	18	7	56	34	155	71	14	12	107	46	264
Math & Comp	44	17	14	16	30	131	15	19	19	19	53	140	21	17	12	63	38	164
All Science	81	39	36	75	81	359	46	44	32	98	118	381	103	36	30	251	112	569
All Subjects	282	235	126	312	427	1,762	298	216	129	446	490	1,945	427	188	94	890	524	2,453

Source: University Statistical Record (unpublished)

Definitions:

Transfer: to another UK university.

Overseas: overseas universities and other overseas employment.

Industry: private industry and commerce (excludes public corporations and self employment).

Other: those not included in previous columns or in other USR specified categories of destination - essentially those going into unemployment and those of unknown destination.

Total: all leavers, including those outside the categories separately identified in this table.

Disciplines: see table 4.2

Table 4.8 (b) Destination, on leaving, of full-time clinical and non-clinical academic staff, by source of funding. All ages, all grades combined. Partially and not university funded.

	1977/78						1978/79						1979/80					
	Transfer	Overseas	Industry	Retired	Other	Total	Transfer	Overseas	Industry	Retired	Other	Total	Transfer	Overseas	Industry	Retired	Other	Total
E & T	24	95	93	1	111	372	37	69	83	3	132	378	39	39	83	1	110	325
Agric. & Vet	10	12	5	3	21	69	10	8	8	6	15	66	10	8	7	1	20	63
Biol. Sci.	45	55	35	3	86	269	52	53	26	3	108	301	60	37	23	0	108	306
Physical Sci.	64	147	54	0	113	417	68	109	65	5	114	423	74	109	69	1	118	410
Math & Comp	13	13	12	0	27	75	24	22	10	0	20	87	12	9	6	0	17	49
All Science	122	215	101	3	226	761	144	184	101	8	242	811	146	155	98	1	243	765
All Subjects	306	440	248	15	619	2,068	352	369	240	36	678	2,134	356	296	228	8	690	2,062

	1980/81						1981/82						1982/83					
	Transfer	Overseas	Industry	Retired	Other	Total	Transfer	Overseas	Industry	Retired	Other	Total	Transfer	Overseas	Industry	Retired	Other	Total
E & T	49	58	50	3	169	369	50	54	56	3	216	426	32	76	75	5	251	492
Agric. & Vet	10	7	5	8	21	74	5	6	5	4	32	63	6	6	8	3	29	61
Biol. Sci.	50	27	28	1	131	292	59	30	35	1	160	332	39	42	33	2	176	339
Physical Sci.	60	105	47	0	161	424	73	130	37	1	254	539	58	120	55	5	278	580
Math & Comp	14	20	9	1	20	75	14	21	9	0	28	82	13	18	11	1	42	101
All Science	124	152	84	2	312	791	146	181	81	2	442	953	110	180	99	8	496	1,020
All Subjects	355	337	188	34	945	2,346	360	359	178	25	1,210	2,559	316	376	231	61	1,263	2,684

	1983/84						1984/85						1985/86					
	Transfer	Overseas	Industry	Retired	Other	Total	Transfer	Overseas	Industry	Retired	Other	Total	Transfer	Overseas	Industry	Retired	Other	Total
E & T	58	62	98	2	258	533	41	70	122	1	307	608	66	68	192	3	337	731
Agric. & Vet	9	5	4	5	32	67	5	7	9	2	28	65	4	13	15	0	32	78
Biol. Sci.	76	41	33	4	199	407	57	44	27	0	226	432	83	57	39	1	251	499
Physical Sci.	95	91	69	1	290	608	103	108	75	0	293	636	85	80	72	1	288	581
Math & Comp	29	19	14	0	38	112	26	14	22	1	46	122	27	17	19	0	65	141
All Science	200	151	116	5	527	1,127	186	166	124	1	565	1,190	195	154	130	2	604	1,221
All Subjects	530	321	290	41	1,400	3,091	392	349	323	12	1,455	3,156	470	345	426	17	1,650	3,529

Table 4.8 (b) (Continued) Destination, on leaving, of full-time clinical and non-clinical academic staff, by source of funding. All ages, all grades combined. Partially and not university funded.

	1986/87						1987/88						1988/89					
	Transfer	Overseas	Industry	Retired	Other	Total	Transfer	Overseas	Industry	Retired	Other	Total	Transfer	Overseas	Industry	Retired	Other	Total
E & T	46	43	155	3	358	688	53	66	183	1	417	802	52	50	189	7	440	802
Agric. & Vet	3	5	7	5	44	76	8	13	10	3	40	95	6	4	8	1	36	65
Biol. Sci.	59	44	57	1	304	520	68	50	73	2	273	545	61	51	71	1	310	549
Physical Sci.	73	91	93	1	266	589	60	95	96	1	310	631	75	104	69	4	380	670
Math & Comp	31	20	17	0	72	152	30	41	27	0	106	220	31	33	17	1	118	216
All Science	163	155	167	2	642	1,261	158	186	196	3	689	1,396	167	188	157	6	808	1,435
All Subjects	383	345	449	40	1,746	3,643	457	420	531	39	1,838	4,052	478	367	491	72	2,100	4,135

Table 4.8 (c) Destination, on leaving, of full-time clinical and non-clinical academic staff, by source of funding. All ages, all grades combined. All sources of funding.

	1977/78						1978/79						1979/80					
	Transfer	Overseas	Industry	Retired	Other	Total	Transfer	Overseas	Industry	Retired	Other	Total	Transfer	Overseas	Industry	Retired	Other	Total
E & T	51	132	117	41	133	550	64	103	100	47	153	543	67	61	101	45	142	498
Agric. & Vet	20	17	13	14	33	125	15	17	19	13	17	115	19	17	14	14	33	124
Biol. Sci.	59	73	40	18	99	356	77	66	34	19	125	400	93	51	33	18	120	409
Physical Sci.	96	190	78	39	145	626	100	157	90	46	145	622	99	132	100	33	158	592
Math & Comp	33	35	20	9	46	168	48	40	15	16	26	168	38	27	18	17	32	154
All Science	188	298	138	66	290	1,150	225	263	139	71	296	1,190	230	210	151	68	310	1,155
All Subjects	683	821	358	337	923	4,075	780	745	347	382	959	4,167	850	600	347	355	1,030	4,126

	1980/81						1981/82						1982/83					
	Transfer	Overseas	Industry	Retired	Other	Total	Transfer	Overseas	Industry	Retired	Other	Total	Transfer	Overseas	Industry	Retired	Other	Total
E & T	81	82	64	78	192	567	83	85	74	94	243	647	59	98	93	292	278	894
Agric. & Vet	19	10	10	21	34	128	10	15	14	14	84	122	9	9	25	48	43	148
Biol. Sci.	67	40	31	19	148	372	81	36	39	32	179	431	51	47	40	87	195	474
Physical Sci.	87	134	71	43	204	624	96	148	52	57	305	721	77	150	70	205	319	909
Math & Comp	37	39	14	21	33	170	32	36	12	25	37	161	30	31	16	101	58	263
All Science	191	213	116	83	385	1,166	209	220	103	114	521	1,313	158	228	126	393	572	1,646
All Subjects	766	627	268	459	1,319	4,372	695	608	254	554	1,575	4,533	654	617	335	1,594	1,665	5,703

	1983/84						1984/85						1985/86					
	Transfer	Overseas	Industry	Retired	Other	Total	Transfer	Overseas	Industry	Retired	Other	Total	Transfer	Overseas	Industry	Retired	Other	Total
E & T	83	81	110	149	294	797	67	80	135	22	359	827	114	80	215	41	386	921
Agric. & Vet	14	7	15	35	46	139	11	12	19	6	38	115	6	16	30	9	39	121
Biol. Sci.	95	48	38	62	212	520	88	46	32	3	250	536	100	64	44	19	276	588
Physical Sci.	125	108	85	141	326	861	157	123	95	22	328	859	133	94	85	17	332	734
Math & Comp	53	26	21	59	53	244	89	29	32	12	74	289	64	41	30	15	103	274
All Science	273	182	144	262	591	1,625	334	198	159	37	652	1,684	297	199	159	51	711	1,596
All Subjects	925	523	366	995	1774	5,499	774	516	408	185	1,900	5,238	858	526	514	295	2,144	5,281

Table 4.8 (c) (Continued) Destination, on leaving, of full-time clinical and non-clinical academic staff, by source of funding. All ages, all grades combined. All sources of funding.

	1986/87						1987/88						1988/89					
	Transfer	Overseas	Industry	Retired	Other	Total	Transfer	Overseas	Industry	Retired	Other	Total	Transfer	Overseas	Industry	Retired	Other	Total
E & T	79	64	179	58	400	881	81	80	215	65	460	1,012	82	61	203	148	483	1,066
Agric. & Vet	5	8	20	12	59	125	10	14	22	12	49	142	12	7	20	12	45	114
Biol. Sci.	68	51	65	21	327	602	80	57	79	25	304	631	72	56	77	82	338	690
Physical Sci.	101	106	107	40	294	735	79	113	103	57	344	786	146	118	81	111	426	934
Math & Comp	75	37	31	16	102	283	45	60	46	19	159	360	52	50	29	64	156	380
All Science	244	194	203	77	723	1,620	204	230	228	101	807	1,777	270	224	187	257	920	2,004
All Subjects	665	582	575	352	2,173	5,405	755	643	660	485	2,328	5,997	905	559	585	962	2,624	6,588

Table 4.9 UK net migration:
a) Wholly university funded academic staff. All ages, all grades.

	1977/1978			1978/1979			1979/1980			1980/1981			1981/1982			1982/1983		
	Out	In	Net	Out	In	Net	Out	In	Net	Out	In	Net	Out	In	Net	Out	In	Net
Eng. & Tech.	37	16	–21	34	22	–12	22	24	+2	24	31	+7	31	14	–17	22	8	–14
Agric. & Vet .	5	11	+6	9	6	–3	9	10	+1	3	5	+2	9	4	–5	4	2	–2
Biol. Sci.	18	18	0	13	15	+2	14	17	+3	13	20	+7	6	6	0	5	2	–3
Physical Sci.	42	29	–13	48	40	–8	23	44	+21	29	39	+10	18	24	+6	30	11	–19
Math & Comp.	22	18	–4	18	11	–7	18	25	+7	19	15	–4	15	9	–6	13	7	–6
All Science	82	65	–17	79	66	–13	55	86	+31	61	74	+13	39	39	0	48	20	–28
All Subjects	381	306	–75	376	349	–27	304	362	+58	290	311	+21	242	210	–32	250	135	–115

	1983/1984			1984/1985			1985/1986			1986/1987			1988/1989			1989/1990		
	Out	In	Net	Out	In	Net	Out	In	Net	Out	In	Net	Out	In	Net	Out	In	Net
Eng. & Tech.	19	16	–3	10	20	+10	12	19	+7	21	22	+1	14	16	+2	11	13	+2
Agric. & Vet .	2	8	+6	5	9	+4	3	7	+4	3	6	+3	1	4	+3	3	9	+6
Biol. Sci.	7	18	+11	2	21	+19	7	19	+12	7	10	+3	7	7	0	5	10	+5
Physical Sci.	17	33	+16	15	51	+36	14	45	+31	15	34	+19	18	15	–3	14	26	+12
Math & Comp.	7	18	+11	15	42	+27	24	25	+1	17	29	+12	19	23	+4	17	21	+4
All Science	31	69	+38	32	114	+82	45	89	+44	39	73	+34	44	45	+1	36	57	+21
All Subjects	202	254	+52	167	294	+127	181	334	+153	235	287	+52	216	234	+18	188	269	+81

Source: Universities Statistical Record (unpublished)

Definitions:

Engineering and technology: subject category 3; cost centre group 7.

Agriculture and veterinary science: subject category 4; cost centre group 4.

Biological science: biology & botany & zoology & physiology/anatomy & biochemistry & other general & combined from within subject category 5; cost centre group 3.

Physical science: subject category 5 minus biological science and mathematics; cost centre group 5.

Mathematics & computing: mathematics from within subject category 5; cost centre group 6.

Science: subject category 5; cost centre groups 3,5,6.

Year: 1977/78 data refer to staff in post as of 31 December 1977.

Table 4.9 UK net migration:
b) Not university funded academic staff. All ages, all grades.

	1977/1978			1978/1979			1979/1980			1980/1981			1981/1982			1982/1983		
	Out	In	Net	Out	In	Net	Out	In	Net	Out	In	Net	Out	In	Net	Out	In	Net
Eng. & tech.	95	39	–56	69	59	–10	39	84	+45	58	72	+14	54	61	+7	76	68	–8
Agric. & Vet .	12	14	+2	8	8	0	8	9	+1	7	9	+2	6	5	–1	6	4	–2
Biol. Sci.	55	35	–20	53	45	–8	37	49	+12	27	46	+19	30	47	+17	42	38	–4
Physical Sci.	147	87	–60	109	145	+36	109	188	+79	105	158	+53	130	120	–10	120	120	0
Math & Comp.	13	21	+8	22	12	–10	9	24	+15	20	27	+7	21	17	–4	18	22	+4
All Science	215	143	–72	184	202	+18	155	261	+106	152	231	+79	181	184	+3	180	180	0
All Subjects	440	283	–157	369	392	+23	296	511	+215	337	422	+85	359	371	+12	367	353	–14

	1983/1984			1984/1985			1985/1986			1986/1987			1987/1988			1988/1989		
	Out	In	Net	Out	In	Net	Out	In	Net	Out	In	Net	Out	In	Net	Out	In	Net
Eng. & tech.	62	83	+21	70	88	+18	68	87	+19	43	121	+78	66	75	+9	50	82	+32
Agric. & Vet .	5	5	0	7	3	–4	13	7	–6	5	11	+6	13	14	+1	4	14	+10
Biol. Sci.	41	71	+30	44	62	+18	57	66	+9	44	84	+40	50	92	+42	51	88	+37
Physical Sci.	91	155	+64	108	131	+23	80	132	+52	91	198	+107	95	195	+100	104	210	+106
Math & Comp.	19	34	+15	14	32	+18	17	52	+35	20	75	+55	41	54	+13	33	38	+5
All Science	151	260	+109	166	225	+59	154	250	+96	155	357	+202	186	341	+155	188	336	+148
All Subjects	321	503	+182	349	461	+112	345	560	+215	345	678	+333	420	643	+223	367	675	+308

Table 4.9 UK net migration:
c) All sources of funding. All ages, all grades.

	1977/1978			1978/1979			1979/1980			1980/1981			1981/1982			1982/1983		
	Out	In	Net	Out	In	Net	Out	In	Net	Out	In	Net	Out	In	Net	Out	In	Net
Eng. & tech.	132	55	–77	103	81	–22	61	108	+47	82	103	+21	85	75	–10	98	76	–22
Agric. & Vet .	17	26	+9	17	14	–3	17	19	+2	10	14	+4	15	9	–6	9	6	–3
Biol. Sci.	73	53	–20	66	60	–6	51	66	+15	40	67	+27	36	53	+17	47	40	–7
Physical Sci.	190	117	–73	157	185	+28	132	232	+100	134	197	+63	148	144	–4	150	131	–19
Math & Comp.	35	39	+4	40	23	–17	27	49	+22	39	42	+3	36	26	–10	31	29	–2
All Science	298	209	–89	263	268	+5	210	347	+137	213	306	+93	220	223	+3	228	200	–28
All Subjects	821	589	–232	745	741	–4	600	880	+280	627	733	+106	608	581	+27	617	489	–128

	1983/1984			1984/1985			1985/1986			1986/1987			1987/1988			1988/1989		
	Out	In	Net	Out	In	Net	Out	In	Net	Out	In	Net	Out	In	Net	Out	In	Net
Eng. & tech.	81	99	+18	80	98	+18	80	106	+26	64	143	+79	80	91	+11	61	95	+34
Agric. & Vet .	7	13	+6	12	12	0	16	15	–1	8	17	+9	14	18	+4	7	24	+17
Biol. Sci.	48	89	+41	46	83	+37	64	85	+21	51	94	+43	57	99	+42	56	98	+42
Physical Sci.	108	188	+80	123	182	+59	94	177	+83	106	232	+126	113	210	+97	118	237	+119
Math & Comp.	26	52	+26	29	74	+45	41	77	+36	37	104	+67	60	77	+17	50	59	+9
All Science	182	329	+147	198	339	+141	199	339	+140	194	430	+236	230	386	+156	224	394	+170
All Subjects	523	757	+234	516	755	+239	526	894	+368	582	965	+383	634	877	+234	559	956	+397

Table 4.9 UK net migration:
d) Professors. All ages, all sources of funding.

	1977/1978			1978/1979			1979/1980			1980/1981			1981/1982			1982/1983		
	Out	In	Net	Out	In	Net	Out	In	Net	Out	In	Net	Out	In	Net	Out	In	Net
Eng. & Tech.	2	0	−2	6	3	−3	2	3	+1	1	5	+4	0	2	+2	1	2	+1
Agric. & Vet .	0	0	0	0	2	+2	1	0	−1	0	0	0	0	1	+1	0	0	0
Biol. Sci.	2	1	−1	1	0	−1	1	0	−1	0	1	+1	0	1	+1	0	0	0
Physical Sci.	2	2	0	1	2	+1	0	0	0	2	2	0	0	1	+1	0	3	+3
Math & Comp.	3	1	−2	3	1	−2	1	0	−1	2	3	+1	1	0	−1	0	2	+2
All Science	7	4	−3	5	3	−2	2	0	−2	4	6	+2	1	2	+1	0	5	+5
All Subjects	28	14	−14	33	26	−7	16	16	0	16	24	+8	13	15	+2	7	18	+11

	1983/1984			1984/1985			1985/1986			1986/1987			1987/1988			1988/1989		
	Out	In	Net	Out	In	Net	Out	In	Net	Out	In	Net	Out	In	Net	Out	In	Net
Eng. & Tech.	1	2	+1	0	2	+2	1	3	+2	2	2	0	3	2	−1	1	0	−1
Agric. & Vet .	0	0	0	1	2	+1	1	1	0	2	4	+2	0	1	+1	0	1	+1
Biol. Sci.	1	0	−1	0	2	+2	3	3	0	0	2	+2	0	0	0	0	2	+2
Physical Sci.	2	2	0	0	4	+4	2	3	+1	1	1	0	2	4	+2	2	4	+2
Math & Comp.	1	1	0	2	3	+1	2	4	+2	3	6	+3	3	2	−1	0	5	+5
All Science	4	3	−1	2	9	+7	7	10	+3	4	9	+5	5	6	+1	2	11	+9
All subjects	22	14	−8	11	31	+20	21	34	+13	28	31	+3	26	22	+4	18	34	+16

Table 4.9 UK net migration:

e) Readers/senior lecturers. All ages, all sources of funding.

	1977/1978			1978/1979			1979/1980			1980/1981			1981/1982			1982/1983		
	Out	In	Net	Out	In	Net	Out	In	Net	Out	In	Net	Out	In	Net	Out	In	Net
Eng. & Tech.	8	0	–8	8	2	–6	5	2	–3	4	0	–4	3	2	–1	4	1	–3
Agric. & Vet .	2	2	0	2	0	–2	1	1	0	2	0	–2	5	0	–5	1	0	–1
Biol. Sci.	3	1	–2	2	0	–2	3	0	–3	0	1	+1	0	0	0	1	0	–1
Physical Sci.	3	1	–2	0	2	+2	5	2	–3	3	1	–2	2	1	–1	5	0	–5
Math & Comp.	3	0	–3	4	2	–2	2	0	–2	2	1	–1	4	0	–4	2	2	0
All Science	9	2	–7	6	4	–2	10	2	–8	5	3	–2	6	1	–5	8	2	–6
All Subjects	64	15	–49	52	27	–25	41	30	–11	50	19	–31	39	18	–21	42	18	–24

	1983/1984			1984/1985			1985/1986			1986/1987			1987/1988			1988/1989		
	Out	In	Net	Out	In	Net	Out	In	Net	Out	In	Net	Out	In	Net	Out	In	Net
Eng. & Tech.	1	2	+1	3	3	0	1	1	0	2	1	–1	1	5	+4	0	2	+2
Agric. & Vet .	1	0	–1	0	0	0	0	0	0	0	0	0	1	0	–1	1	0	–1
Biol. Sci.	2	0	–2	2	0	–2	3	3	0	4	0	–4	4	0	–4	0	0	0
Physical Sci.	6	0	–6	1	0	–1	1	0	–1	4	1	–3	2	2	0	4	3	–1
Math & Comp.	1	3	+2	3	0	–3	2	3	+1	5	1	–4	4	1	–3	6	1	–5
All Science	9	3	–6	6	0	–6	7	6	–1	13	2	–11	10	3	–7	10	4	–6
All Subjects	44	20	–24	30	14	–16	18	28	+10	50	22	–28	42	29	–13	27	23	–4

Table 5.1 Research Council expenditure on items other than direct research £K (cash terms)

	1977/1978	1978/1979	1979/1980	1980/1981	1981/1982	1982/1983	1983/1984	1984/1985	1985/1986	1986/1987	1987/1988	1988/1989
AFRC												
Administration	2,704	3,244	4,425	6,164	6,497	8,345	3,516	3,505	3,760	4,422	4,398	5,142
Superannuation	1,149	1,519	2,366	3,575	3,463	5,079	6,973	10,388	15,408	13,801	12,672	15,741
Land and buildings	3,042	4,881	4,819	4,039	6,198	7,378	5,512	5,312	4,967	7,083	3,931	5,481
AFRC total	6,895	9,644	11,610	13,778	16,158	20,802	16,001	19,205	24,135	25,306	21,001	26,364
1990 pounds (GDP deflator)	*19,028*	*24,042*	*24,782*	*24,851*	*26,544*	*31,872*	*23,423*	*26,783*	*31,946*	*32,395*	*25,516*	*29,903*
ESRC												
Administration	1,239	1,319	1,539	2,047	2,145	2,366	2,467	2,407	2,596	2,430	2,484	3,140
Superannuation								327	579	616	522	707
ESRC total	1,239	1,319	1,539	2,047	2,145	2,366	2,467	2,734	3,175	3,046	3,006	3,847
1990 pounds (GDP deflator)	*3,419*	*3,288*	*3,285*	*3,692*	*3,524*	*3,625*	*3,611*	*3,813*	*4,203*	*3,899*	*3,652*	*4,363*
MRC												
Superannuation	344	461	529	656	879	1,033	1,068	1,396	1,473	1,507	1,689	1,659
New building	1,369	2,554	3,078	2,106	2,194	2,687	2,294	2,953	2,995	3,686	5,041	3,998
Headquarters	2,428	2,623	3,200	4,213	4,889	5,153	5,449	5,648	5,886	6,611	6,882	7,365
MRC total	4,141	5,638	6,807	6,975	7,962	8,873	8,811	9,997	10,354	11,804	13,612	13,022
1990 pounds (GDP deflator)	*11,427*	*14,056*	*14,530*	*12,581*	*13,080*	*13,594*	*12,898*	*13,942*	*13,705*	*15,111*	*16,539*	*14,770*
NERC												
Superannuation	653	653	920	1,396	2,026	2,403	2,043	2,723	2,950	3,409	3,742	4,907
Relocation	n/a	n/a	356	406	499	575	789	625	519	533	527	430
New building	842	577	1,035	1,134	2,444	2,072	2,526	2,781	1,734	1,310	560	2,488
Restructuring	0	0	0	0	0	0	333	908	2,266	1,711	1,724	3,408
Premises	n/a	n/a	1,337	1,804	2,034	2,177	2,104	2,217	1,937	1,792	1,771	1,737
Headquarters	1,818	2,478	2,207	2,503	2,643	2,516	2,927	2,847	3,198	3,570	3,580	3,767
NERC total	3,313	3,708	5,855	7,243	9,646	9,743	10,722	12,101	12,604	12,325	11,904	16,737
1990 pounds (GDP deflator)	*9,143*	*9,244*	*12,498*	*13,064*	*15,846*	*14,928*	*15,695*	*16,876*	*16,683*	*15,778*	*14,463*	*18,984*
SERC												
Administration	5,513	5,447	4,667	5,882	6,292	7,441	9,234	10,084	11,390	10,874	12,848	16,366
Superannuation	466	583	674	816	1,398	1,526	2,243	2,653	2,695	1,807	2,606	3,414
Land and buildings	3,274	3,051	3,017	3,662	4,137	4,412	4,105	4,389	3,531	941	476	1,810
Premises	1,381	1,161	1,002	1,119	1,261	1,717	1,700	1,700	2,000	2,000	2,100	2,753
SERC total	10,634	10,242	9,360	11,479	13,088	15,096	17,282	18,826	19,616	15,622	18,030	24,343
1990 pounds (GDP deflator)	*29,346*	*25,533*	*19,979*	*20,704*	*21,501*	*23,129*	*25,298*	*26,254*	*25,964*	*19,998*	*21,907*	*27,610*

Table 5.1 Research Council expenditure on items other than direct research £K (cash terms) (cont'd)

Definitions: administration includes salaries and wages of non-research staff, central running costs and other central recurrent expenditure.

Headquarters includes administration and some capital expenditure.

Premises: rent and rates.

Notes: AFRC - administration includes superannuation until 1983/84 and other central expenses; superannuation includes staff restructuring costs.

ESRC - administration includes superannuation until 1984/85. SERC - premises includes maintenance.

Table 5.2 Research expenditure per member of full-time academic staff in departments of science and engineering in UK universities

	1981/1982	1982/1983	1983/1984	1984/1985	1985/1986	1986/1987	1987/1988	1988/1989
Research expenditure £M (cash)								
UGC*	281	308	318	325	388	420	440	455
Other research grants and contracts	118	138	158	184	217	254	269	314
Total research expenditure	399	446	476	509	605	674	709	769
Full time academic staff:								
Long-term staff	13,410	12,525	12,393	12,664	12,929	13,056	13,011	12,444
All staff	18,778	18,454	18,654	19,287	20,024	20,885	21,213	21,055
Expenditure per member of staff £K (cash)								
Long-term staff	29.8	35.6	38.4	40.2	46.8	51.6	54.5	61.8
1990 pounds (GDP deflator)	*48.9*	*54.6*	*56.2*	*56.1*	*61.9*	*66.1*	*66.2*	*70.1*
1990 pounds (UPPI)	*50.9*	*57.8*	*59.3*	*59.0*	*65.4*	*67.7*	*64.6*	*69.1*
All staff	21.2	24.2	25.5	26.4	30.2	32.3	33.4	36.5
1990 pounds (GDP deflator)	*34.9*	*37.0*	*37.4*	*36.8*	*40.0*	*41.3*	*40.6*	*41.4*
1990 pounds (UPPI)	*36.4*	*39.2*	*39.4*	*38.8*	*42.3*	*42.4*	*39.6*	*40.9*

Definitions:

UGC - Natural science, engineering and technology only.

Other - Covers only research grants and contracts, from non-UGC sources, secured by departments and cost centres in science (including mathematics), agriculture and engineering. Source: USR volume III, table 9.

Staff - Data from table 4.2. Long-term: covers staff funded wholly by the UGC; all staff: includes those funded by other sources

* figures refer to income, not expenditure

Total expenditure refers to UGC income for research from the DES and university income for research from other sources.

Other includes research councils, UK Government, charities and industry, and miscellaneous.

Table 5.3 Research grant applications, awards and alpha rating (values in £M, cash terms).
Table 5.3 (a) AFRC

	1977/1978	1978/1979	1979/1980	1980/1981	1981/1982	1982/1983	1983/1984	1984/1985	1985/1986	1986/1987	1987/1988
Total number of applications		218	226	228	271	257	314	454	401	355	346
Total number of awards		103	94	107	134	105	142	124	98	91	124
% awarded (number)		47%	42%	47%	49%	41%	45%	27%	24%	26%	36%
Total value of applications		5.5	5.4	7.5	8.2	8.4	9.3	22.1	21.4	21.2	20.8
Total value awarded		2.5	1.9	4.4	3.9	2.4	4.8	5.5	4.1	5.5	7.0
% awarded (value)		45%	35%	59%	48%	29%	52%	25%	19%	26%	34%
Total number A-rated		103	94	107	134	152	181	212	176	193	170
Number of A-rated funded		103	94	107	134	105	142	124	98	91	124
% A-rated funded (number)		100%	100%	100%	100%	69%	78%	58%	56%	47%	73%
Total value of A-rated		2.5	1.9	4.4	3.9	3.6	6.3	10.4	8.1	10.8	9.6
Value of A-rated funded		2.5	1.9	4.4	3.9	2.4	4.8	5.5	4.1	5.5	7.0
% A-rated funded (value)		100%	100%	100%	100%	67%	76%	53%	51%	51%	73%
A-rated as % of total		47%	42%	47%	49%	59%	58%	47%	44%	54%	49%
A-rated funded as % total funded		100%	100%	100%	100%	100%	100%	100%	100%	100%	100%

Source: AFRC Annual Reports

Table 5.3 (b) ESRC

	1977/1978	1978/1979	1979/1980	1980/1981	1981/1982	1982/1983	1983/1984	1984/1985	1985/1986	1986/1987	1987/1988
Total number of applications	638	749	666	884	532	628	513	471	510	433	319
Total number of awards	304	370	303	364	177	232		186	180	128	106
% awarded (number)	48%	49%	45%	41%	33%	37%		39%	35%	30%	33%
Total value of applications	11.4	13.5	14.2	20.9	17.3	20.0	16.9	16.8	17.9	15.6	13.0
Total value awarded	3.3	4.6	4.6	5.2	4.4	5.8		5.2	4.5	2.9	3.4
% awarded (value)	29%	34%	32%	25%	25%	29%		31%	25%	19%	26%
Total number A-rated				459	240	325					
Number of A-rated funded				364	177	232		186	180	128	106
% A-rated funded (number)				79%	74%	71%					
Total value of A-rated				7.3	6.4	7.7					
Value of A-rated funded				5.2	4.4	5.8		5.2	4.5	2.9	3.4
% A-rated funded (value)				71%	69%	75%					
A-rated as % of total				52%	45%	52%					
A-rated funded as % total funded				100%	100%	100%		100%	100%	100%	100%

Source: ESRC Annual Reports and ABRC

Table 5.3 (c) MRC

	1977/1978	1978/1979	1979/1980	1980/1981	1981/1982	1982/1983	1983/1984	1984/1985	1985/1986	1986/1987	1987/1988
Total number of applications			977	1,161	1,156	1,096	1,239	969	922	998	804
Total number of awards			536	524	549	575	473	437	439	411	407
% awarded (number)			55%	45%	47%	52%	38%	45%	48%	41%	51%
Total value of applications			35.3	46.7	50.8	51.8	64.5	53.8	54.3	57.4	47.7
Total value awarded			15.2	16.9	20.4	22.2	20.8	18.5	20.6	18.2	18.1
% awarded (value)			43%	36%	40%	43%	32%	34%	38%	32%	38%
Total number A-rated								524	529	641	505
Number of A-rated funded			536	524	549	575	473	437	439	411	407
% A-rated funded (number)								83%	83%	64%	81%
Total value of A-rated											
Value of A-rated funded											
% A-rated funded (value)											
A-rated as % of total								54%	57%	64%	63%
A-rated funded as % total funded			100%	100%	100%	100%	100%	100%	100%	100%	100%

Source: MRC Headquarters
Figures are for projects grants
Notes: before 1987/88 grants were not A-rated, therefore figures for A-rated refer to approved grants

Table 5.3 (d) NERC

	1977/1978	1978/1979	1979/1980	1980/1981	1981/1982	1982/1983	1983/1984	1984/1985	1985/1986	1986/1987	1987/1988
Total number of applications	355	331	354	340	427	397	446	368	417	418	377
Total number of awards	180	186	167	176	162	180	116	128	115	154	134
% awarded (number)	51%	56%	47%	52%	38%	45%	26%	35%	28%	37%	36%
Total value of applications	6.1	6.7	10.0	8.6	12.6	13.8	17.2	15.4	17.8	19.1	20.4
Total value awarded	2.3	3.0	4.0	3.4	3.7	4.0	3.5	3.7	3.9	5.4	5.9
% awarded (value)	37%	45%	40%	40%	29%	29%	20%	24%	22%	28%	29%
Total number A-rated		188	222	226	313	240	305	235	296	290	207
Number of A-rated funded		186	167	176	160	180	120	128	115	154	134
% A-rated funded (number)		99%	75%	78%	51%	75%	39%	54%	39%	53%	65%
Total value of A-rated		3.1	5.1	3.8	7.7	6.0	10.7	7.6	12.2	11.5	9.2
Value of A-rated funded		3.0	4.0	3.4	3.7	4.0	3.5	3.7	3.9	5.4	5.9
% A-rated funded (value)		98%	78%	90%	48%	67%	33%	49%	32%	47%	64%
A-rated as % of total		57%	63%	66%	73%	60%	68%	64%	71%	69%	55%
A-rated funded as % total funded		100%	100%	100%	99%	100%	103%	100%	100%	100%	100%

Source: NERC Headquarters and Annual Reports

Table 5.3 (e) SERC

	1977/1978	1978/1979	1979/1980	1980/1981	1981/1982	1982/1983	1983/1984	1984/1985	1985/1986	1986/1987	1987/1988
ALL APPLICATIONS											
Total number of applications	3,043	4,625	3,469	3,684	4,412	4,756	4,847	4,369	4,894	5,422	4,513
Total number of awards	1,883	2,412	1,892	2,047	1,980	2,141	2,151	2,216	2,513	2,362	1,884
% awarded (number)	62%	52%	55%	56%	45%	45%	44%	51%	51%	44%	42%
Total value of applications	80.3	143.9	114.2	158.1	195.3	226.9	224.7	255.1	316.4	357.4	432.7
Total value awarded	43.9	62.5	48.8	77.5	73.1	85.5	80.5	100.6	128.4	123.6	142.9
% awarded (value)	55%	43%	43%	49%	37%	38%	36%	39%	41%	35%	33%
ALL GRADED APPLICATIONS*											
Total number A-rated				1,714	1,892	2,136	2,086	2,118	2,237	2,433	2,056
Number of A-rated funded				1,556	1,441	1,634	1,584	1,691	1,788	1,455	1,339
% A-rated funded (number)				91%	76%	76%	76%	80%	80%	60%	65%
Total value of A-rated				49.7	68.9	72.9	63.1	75.0	86.9	100.1	122.0
Value of A-rated funded				46.3	52.8	57.9	47.1	58.2	68.2	53.1	72.0
% A-rated funded (value)				93%	77%	79%	75%	78%	78%	53%	59%
A-rated as % of total				47%	43%	45%	43%	48%	46%	45%	46%
A-rated funded as % total funded				76%	73%	76%	74%	76%	71%	62%	71%

Source: SERC Headquarters and Annual Reports

* Research grant applications assessed by the Nuclear Physics Board, or concerned with directed programmes dealt with by special directorates, do not come under the alpha-grading system

Table 5.4 (1) First destinations of first degree graduates from UK universities by class of degree: primary classification

a) Disciplines: Engineering and technology

Graduation year	Class of degree	Total graduates	Total of known destination	Permanent and short-term home employment		Home research or academic study *	
	1	903	876	516	58.9%	192	21.9%
	2 i	1,982	1,888	1,242	65.8%	312	16.5%
1978	2 ii	2,615	2,459	1,743	70.9%	233	9.5%
	All classes	8,645	8,026	5,356	66.7%	884	11.0%
	1	852	815	489	60.0%	183	22.5%
	2 i	2,224	2,113	1,340	62.4%	294	13.9%
1980	2 ii	3,043	2,808	1,816	64.7%	200	7.1%
	All classes	9,507	8,788	5,344	60.8%	812	9.2%
	1	954	928	524	56.5%	185	19.9%
	2 i	2,678	2,531	1,528	60.4%	386	15.3%
1982	2 ii	3,364	3,085	1,886	61.1%	225	7.3%
	All classes	10,284	9,444	5,425	57.4%	907	9.6%
	1	1,083	1,049	700	66.7%	189	18.0%
	2 i	2,806	2,687	1,953	72.7%	315	11.7%
1984	2 ii	3,551	3,291	2,263	68.8%	249	7.6%
	All classes	10,542	9,766	6,512	66.7%	854	8.7%
	1	1,141	1,093	724	66.2%	200	18.3%
	2 i	2,964	2,827	2,091	74.0%	324	11.5%
1985	2 ii	3,381	3,102	2,210	71.2%	233	7.5%
	All classes	10,284	9,457	6,500	68.7%	844	8.9%
	1	1,078	1,058	693	65.5%	180	17.0%
	2 i	2,608	2,485	1,745	70.2%	329	13.2%
1986	2 ii	2,880	2,668	1,920	72.0%	192	7.2%
	All classes	8,730	8,086	5,447	67.4%	759	9.4%
	1	1,082	1,053	681	64.7%	178	16.9%
	2 i	2,627	2,500	1,722	70.9%	288	11.5%
1987	2 ii	2,918	2,723	1,946	71.5%	184	6.8%
	All classes	8,801	8,188	5,558	67.9%	732	8.9%
	1	1,115	1,068	667	62.5%	191	17.9%
	2 i	2,839	2,689	1,943	72.3%	290	10.8%
1988	2 ii	3,019	2,780	1,938	69.7%	203	7.3%
	All classes	9,114	8,419	5,658	67.2%	758	9.0%

* Postgraduate degrees or further degree-level study; excludes PGCE and other training

Source: Universities Statistical Record (unpublished)

Table 5.4 (1) First destinations of first degree graduates from UK universities by class of degree: primary classification

b) Discipline: Science

Graduation year	Class of degree	Total graduates	Total of known destination	Permanent and short-term home employment		Home research or academic study *	
1978	1	1,511	1,461	482	33.0%	820	54.3%
	2 i	3,731	3,559	1,578	44.7%	1,386	37.1%
	2 ii	4,475	4,098	2,455	59.9%	486	10.9%
	All classes	14,377	13,220	6,995	52.9%	3,039	21.1%
1980	1	1,403	1,359	433	31.9%	711	52.3%
	2 i	3,899	3,700	1,514	40.9%	1,377	37.2%
	2 ii	4,646	4,253	2,195	51.6%	448	10.5%
	All classes	15,093	13,892	6,445	46.4%	2,931	21.1%
1982	1	1,558	1,519	447	29.4%	779	51.3%
	2 i	4,449	4,224	1,598	37.8%	1,477	35.0%
	2 ii	5,300	4,796	2,280	47.5%	477	9.9%
	All classes	16,552	15,032	6,229	41.4%	3,119	20.7%
1984	1	1,798	1,732	663	38.3%	842	48.6%
	2 i	5,170	4,925	2,363	48.0%	1,704	34.6%
	2 ii	5,584	5,051	2,932	58.0%	500	9.9%
	All classes	17,407	15,909	8,087	50.8%	3,313	20.8%
1985	1	1,928	1,867	727	38.9%	893	47.8%
	2 i	5,370	5,079	2,600	51.2%	1,616	31.8%
	2 ii	5,609	5,001	3,004	60.1%	537	10.7%
	All classes	17,500	15,825	8,431	53.3%	3,328	21.0%
1986	1	1,932	1,867	699	37.4%	918	49.2%
	2 i	5,730	5,385	2,738	50.8%	1,702	31.6%
	2 ii	5,502	4,940	3,031	61.4%	551	11.2%
	All classes	16,158	14,689	7,837	53.4%	3,275	22.3%
1987	1	1,947	1,895	734	38.7%	896	47.3%
	2 i	5,881	5,575	2,837	50.9%	1,719	30.8%
	2 ii	5,439	4,950	3,100	62.6%	553	11.2%
	All classes	16,386	15,073	8,191	54.3%	3,310	22.0%
1988	1	1,983	1,931	797	41.3%	843	43.7%
	2 i	6,072	5,710	2,908	50.9%	1,699	29.8%
	2 ii	5,315	4,798	2,979	62.1%	576	12.0%
	All classes	16,214	14,852	8,150	54.9%	3,226	21.7%

* Postgraduate degrees or further degree-level study; excludes PGCE and other training

Source: Universities Statistical Record (unpublished)

Table 5.4 (1) First destinations of first degree graduates from UK universities by class of degree: primary classification

c) All disciplines

Graduation year	Class of degree	Total graduates	Total of known destination	Permanent and short-term home employment		Home research or academic study *	
	1	3,847	3,690	1,463	39.6%	1,559	42.2%
	2 i	16,475	15,247	7,642	50.1%	3,203	21.0%
1978	2 ii	22,366	19,977	11,385	57.0%	1,121	5.6%
	All classes	63,056	57,094	32,608	57.1%	6,635	11.6%
	1	3,737	3,586	1,446	40.3%	1,365	38.1%
	2 i	17,665	16,390	7,618	46.5%	2,953	18.0%
1980	2 ii	24,076	21,404	10,922	51.0%	1,044	4.9%
	All classes	67,368	60,962	31,966	52.4%	6,174	10.1%
	1	4,055	3,878	1,483	38.2%	1,409	36.3%
	2 i	20,300	18,747	8,410	44.9%	3,105	16.6%
1982	2 ii	25,776	22,819	10,934	47.9%	1,113	4.9%
	All classes	71,872	64,547	31,696	49.1%	6,426	10.0%
	1	4,609	4,373	2,037	46.6%	1,507	34.5%
	2 i	22,526	20,627	10,776	52.2%	3,294	16.0%
1984	2 ii	25,739	22,635	12,404	54.8%	1,110	4.9%
	All classes	72,973	65,377	36,445	55.7%	6,534	10.6%
	1	4,868	4,623	2,155	46.6%	1,565	33.9%
	2 i	22,854	20,953	11,434	54.6%	3,149	15.0%
1985	2 ii	25,072	21,960	12,552	57.2%	1,155	5.3%
	All classes	72,046	64,330	37,166	57.8%	6,492	10.1%
	1	5,157	4,932	2,264	45.9%	1,660	33.7%
	2 i	24,489	22,548	12,315	54.6%	3,466	15.4%
1986	2 ii	24,495	21,636	12,549	58.0%	1,210	5.6%
	All classes	69,923	62,802	36,589	58.3%	6,664	10.6%
	1	5,213	4,978	2,348	47.2%	1,661	33.4%
	2 i	25,736	23,630	12,978	54.9%	3,449	14.6%
1987	2 ii	24,698	21,849	13,006	59.5%	1,214	5.6%
	All classes	71,574	64,496	38,304	59.4%	6,722	10.4%
	1	5,537	5,280	2,509	47.5%	1,594	30.2%
	2 i	27,251	25,153	13,833	55.0%	3,590	14.3%
1988	2 ii	24,570	21,707	12,645	58.3%	1,288	5.9%
	All classes	72,589	65,525	38,573	53.1%	6,750	9.3%

* Postgraduate degrees or further degree-level study; excludes PGCE and other training
Source: Universities Statistical Record (unpublished)

Table 5.4 (2) First destinations of first degree graduates from UK universities by class of degree: employer category

a) Disciplines: Engineering and technology

Graduation year	Class of degree	Total permanent home employment	Industry *		Commerce **	
1978	1	512	447	87.3%	17	3.3%
	2 i	1,226	1,030	84.0%	46	3.8%
	2 ii	1,716	1,427	83.2%	73	4.3%
	All classes	5,261	4,401	83.7%	201	3.8%
1980	1	488	410	84.0%	19	3.9%
	2 i	1,337	1,129	84.4%	71	5.3%
	2 ii	1,803	1,516	84.1%	75	4.2%
	All classes	5,288	4,452	84.2%	237	4.5%
1982	1	520	434	83.5%	22	4.2%
	2 i	1,515	1,260	83.2%	87	5.7%
	2 ii	1,848	1,508	81.6%	126	6.8%
	All classes	5,325	4,325	81.2%	354	6.6%
1984	1	698	616	88.3%	40	5.7%
	2 i	1,942	1,606	82.7%	159	8.2%
	2 ii	2,227	1,836	82.4%	161	7.2%
	All classes	6,417	5,244	81.7%	511	8.0%
1985	1	724	609	84.1%	58	8.0%
	2 i	2,080	1,739	83.6%	154	7.4%
	2 ii	2,178	1,776	81.5%	178	8.2%
	All classes	6,412	5,222	81.4%	536	8.4%
1986	1	689	564	81.9%	56	8.1%
	2 i	1,737	1,418	81.6%	166	9.6%
	2 ii	1,894	1,477	78.0%	193	10.2%
	All classes	5,362	4,225	78.8%	529	9.9%
1987	1	680	520	76.5%	111	16.3%
	2 i	1,756	1,306	74.4%	288	16.4%
	2 ii	1,918	1,429	74.5%	252	13.1%
	All classes	5,478	4,063	74.2%	802	14.6%
1988	1	653	503	77.0%	103	15.8%
	2 i	1,899	1,459	76.8%	288	15.2%
	2 ii	1,896	1,454	76.7%	249	13.1%
	All classes	5,566	4,263	76.6%	766	13.8%

* Agriculture, forestry and fisheries; oil, mining, chemical and allied industries; engineering and allied industries; other manufacturing industries and industrial services; building, civil engineering and architecture; public utilities, transport and communications

** Accountancy; banking, insurance and finance; other commerce and commercial services

Source: Universities Statistical Record (unpublished)

Table 5.4 (2) First destinations of first degree graduates from UK universities by class of degree: employer category

b) Discipline: Science

Graduation year	Class of degree	Total permanent home employment	Industry *		Commerce **	
1978	1	468	219	46.8%	143	30.6%
	2 i	1,441	700	48.6%	289	20.1%
	2 ii	2,195	1,046	47.7%	435	19.8%
	All classes	6,324	3,127	49.4%	1,405	22.2%
1980	1	429	206	48.0%	128	29.8%
	2 i	1,457	664	45.6%	377	25.9%
	2 ii	2,108	985	46.7%	511	24.2%
	All classes	6,165	2,926	47.5%	1,624	26.3%
1982	1	444	203	45.7%	137	30.9%
	2 i	1,517	623	41.1%	412	27.2%
	2 ii	2,121	877	41.3%	612	28.9%
	All classes	5,860	2,421	41.3%	1,781	30.4%
1984	1	657	287	43.7%	264	40.2%
	2 i	2,166	939	43.4%	683	31.5%
	2 ii	2,760	1,203	43.6%	880	31.9%
	All classes	7,655	3,293	43.0%	2,541	33.2%
1985	1	719	318	44.2%	281	39.1%
	2 i	2,489	1,039	41.7%	842	33.8%
	2 ii	2,820	1,119	39.7%	966	34.3%
	All classes	8,020	3,252	40.5%	2,840	35.4%
1986	1	684	285	41.7%	257	37.6%
	2 i	2,607	915	35.1%	978	37.5%
	2 ii	2,805	931	33.2%	1,018	36.3%
	All classes	7,345	2,557	34.8%	2,738	37.3%
1987	1	724	274	37.8%	334	46.1%
	2 i	2,721	918	33.7%	1,063	39.1%
	2 ii	2,911	1,006	34.6%	1,139	39.1%
	All classes	7,747	2,646	34.2%	3,107	40.1%
1988	1	782	283	36.2%	368	47.1%
	2 i	2,757	994	36.1%	1,037	37.6%
	2 ii	2,757	1,055	38.3%	1,013	34.7%
	All classes	7,641	2,810	36.8%	2,944	38.5%

* Agriculture, forestry and fisheries; oil, mining, chemical and allied industries; engineering and allied industries; other manufacturing industries and industrial services; building, civil engineering and architecture; public utilities, transport and communications

** Accountancy; banking, insurance and finance; other commerce and commercial services

Source: Universities Statistical Record (unpublished)

Table 5.4 (2) First destinations of first degree graduates from UK universities by class of degree: employer category

c) All disciplines

Graduation year	Class of degree	Total permanent home employment	Industry *		Commerce **	
	1	1,387	749	54.0%	272	19.6%
	2 i	6,896	2,574	37.3%	1,624	23.5%
1978	2 ii	10,058	3,755	37.3%	2,600	25.9%
	All classes	29,651	10,381	35.0%	6,338	21.4%
	1	1,416	706	49.9%	345	24.4%
	2 i	7,246	2,650	36.6%	2,288	31.6%
1980	2 ii	10,272	3,724	36.3%	3,445	33.5%
	All classes	30,501	10,153	33.3%	8,195	26.9%
	1	1,458	734	50.3%	342	23.5%
	2 i	7,997	2,698	33.7%	2,685	33.6%
1982	2 ii	10,161	3,377	33.2%	3,520	34.6%
	All classes	30,115	9,108	30.2%	8,615	28.6%
	1	1,995	1,019	51.1%	551	27.6%
	2 i	10,207	3,549	34.8%	3,424	33.5%
1984	2 ii	11,527	4,217	36.6%	3,870	33.6%
	All classes	34,517	11,259	32.6%	9,904	28.7%
	1	2,102	1,039	49.4%	632	30.1%
	2 i	10,859	3,836	35.3%	3,709	34.2%
1985	2 ii	11,730	4,023	34.3%	4,173	35.6%
	All classes	35,309	11,187	31.7%	10,524	29.8%
	1	2,202	1,016	46.1%	674	30.6%
	2 i	11,680	3,695	31.6%	4,486	38.4%
1986	2 ii	11,664	3,708	31.8%	4,393	37.7%
	All classes	34,645	10,100	29.2%	11,084	32.0%
	1	2,304	962	41.8%	866	37.6%
	2 i	12,324	3,637	29.5%	5,024	40.8%
1987	2 ii	12,115	3,769	31.1%	4,772	39.4%
	All classes	36,365	10,107	27.8%	12,344	33.9%
	1	2,243	99	40.9%	908	37.2%
	2 i	13,055	3,943	30.2%	5,366	41.1%
1988	2 ii	11,670	3,853	33.0%	4,446	38.1%
	All classes	36,441	10,628	29.2%	12,196	33.5%

* Agriculture, forestry and fisheries; oil, mining, chemical and allied industries; engineering and allied industries; other manufacturing industries and industrial services; building, civil engineering and architecture; public utilities, transport and communications

** Accountancy; banking, insurance and finance; other commerce and commercial services

Source: Universities Statistical Record (unpublished)

Table 5.4 (3) First destinations of first degree graduates from UK universities by class of degree: type of work

a) Disciplines: Engineering and technology

Graduation year	Class of degree	Total permanent home employment	Research and research support *		Management and financial services	
1978	1	512	271	52.9%	34	6.6%
	2 i	1,226	593	48.4%	69	5.6%
	2 ii	1,716	795	46.3%	103	6.0%
	All classes	5,261	2,452	46.6%	320	6.1%
1980	1	488	364	74.6%	24	4.9%
	2 i	1,337	898	67.2%	76	5.7%
	2 ii	1,803	1,159	64.3%	98	5.4%
	All classes	5,288	3,518	66.5%	289	5.5%
1982	1	520	406	78.1%	23	4.4%
	2 i	1,515	1,040	68.6%	103	6.8%
	2 ii	1,848	1,220	66.0%	113	6.1%
	All classes	5,325	3,568	67.0%	337	6.3%
1984	1	698	543	77.8%	45	6.4%
	2 i	1,942	1,353	69.7%	176	9.1%
	2 ii	2,227	1,500	67.4%	208	9.3%
	All classes	6,417	4,313	67.2%	580	9.0%
1985	1	724	541	74.7%	67	9.3%
	2 i	2,080	1,458	70.1%	180	8.7%
	2 ii	2,178	1,449	66.5%	209	9.6%
	All classes	6,412	4,296	67.0%	606	9.5%
1986	1	689	514	74.6%	79	11.5%
	2 i	1,737	1,191	68.6%	219	12.6%
	2 ii	1,894	1,231	65.0%	224	11.8%
	All classes	5,362	3,562	66.4%	631	11.8%
1987	1	680	449	66.0%	126	18.5%
	2 i	1,756	1,130	64.4%	300	17.1%
	2 ii	1,918	1,148	59.9%	282	14.7%
	All classes	5,478	3,331	60.8%	841	15.4%
1988	1	653	442	67.7%	106	16.2%
	2 i	1,899	1,190	62.7%	340	17.9%
	2 ii	1,896	1,129	59.5%	299	15.8%
	All classes	5,566	3,352	60.2%	884	15.9%

* Scientific and engineering research, design and development; scientific and engineering support services

Source: Universities Statistical Record (unpublished)

Table 5.4 (3) First destinations of first degree graduates from UK universities by class of degree: type of work

b) Discipline: Science

Graduation year	Class of degree	Total permanent home employment	Research and research support *		Management and financial services	
1978	1	468	154	32.9%	225	48.1%
	2 i	1,441	581	40.3%	484	33.6%
	2 ii	2,195	814	37.1%	740	33.7%
	All classes	6,324	2,194	34.7%	2,424	38.3%
1980	1	429	168	39.2%	196	45.7%
	2 i	1,457	570	39.1%	495	34.0%
	2 ii	2,108	784	37.2%	733	34.8%
	All classes	6,165	2,186	35.5%	2,342	38.0%
1982	1	444	168	37.8%	216	48.6%
	2 i	1,517	541	35.7%	591	39.0%
	2 ii	2,121	674	31.8%	783	36.9%
	All classes	5,860	1,825	31.1%	2,325	39.7%
1984	1	657	208	31.7%	366	55.7%
	2 i	2,166	758	35.0%	913	42.2%
	2 ii	2,760	847	30.7%	1,160	42.0%
	All classes	7,655	2,296	30.0%	3,343	43.7%
1985	1	719	239	33.2%	395	54.9%
	2 i	2,489	806	32.4%	1,085	43.6%
	2 ii	2,820	853	30.2%	1,203	42.7%
	All classes	8,020	2,363	29.5%	3,586	44.7%
1986	1	684	236	34.5%	336	49.1%
	2 i	2,607	751	28.8%	1,162	44.6%
	2 ii	2,805	702	25.0%	1,212	43.2%
	All classes	7,345	1,940	26.4%	3,304	45.0%
1987	1	724	216	29.8%	401	55.4%
	2 i	2,721	766	28.2%	1,213	44.6%
	2 ii	2,911	835	28.7%	1,230	42.3%
	All classes	7,747	2,015	26.0%	3,473	44.8%
1988	1	782	248	31.7%	414	52.9%
	2 i	2,757	771	28.0%	1,186	43.0%
	2 ii	2,757	741	26.9%	1,157	42.0%
	All classes	7,641	2,027	26.5%	3,362	44.0%

* Scientific and engineering research, design and development; scientific and engineering support services

Source: Universities Statistical Record (unpublished)

Table 5.4 (3) First destinations of first degree graduates from UK universities by class of degree: type of work

c) All disciplines

Graduation year	Class of degree	Total permanent home employment	Research and research support *		Management and financial services	
1978	1	1,387	435	31.4%	369	26.6%
	2 i	6,896	1,258	18.2%	1,672	24.2%
	2 ii	10,058	1,701	16.9%	2,577	25.6%
	All classes	29,651	4,860	16.4%	6,698	22.6%
1980	1	1,416	546	38.6%	379	26.8%
	2 i	7,246	1,580	21.8%	1,922	26.5%
	2 ii	10,272	2,029	19.8%	2,873	28.0%
	All classes	30,501	5,971	19.6%	7,240	23.7%
1982	1	1,458	591	40.5%	408	28.0%
	2 i	7,997	1,681	21.0%	2,276	28.5%
	2 ii	10,161	1,991	19.6%	2,655	26.1%
	All classes	30,115	5,637	18.7%	7,038	23.4%
1984	1	1,995	770	38.6%	600	30.1%
	2 i	10,207	2,253	22.1%	2,920	28.6%
	2 ii	11,527	2,439	21.2%	3,231	28.0%
	All classes	34,517	6,884	19.9%	8,641	25.0%
1985	1	2,102	794	37.8%	701	33.3%
	2 i	10,859	2,390	22.0%	3,267	30.1%
	2 ii	11,730	2,404	20.5%	3,404	29.0%
	All classes	35,309	6,923	19.6%	9,246	26.2%
1986	1	2,202	804	36.5%	721	32.7%
	2 i	11,680	2,205	18.9%	3,926	33.6%
	2 ii	11,664	2,175	18.6%	3,605	30.9%
	All classes	34,645	6,150	17.8%	9,625	27.8%
1987	1	2,304	721	31.3%	840	36.5%
	2 i	12,324	2,170	17.6%	4,084	33.1%
	2 ii	12,115	2,119	17.5%	3,745	30.9%
	All classes	36,365	5,988	16.5%	10,183	28.0%
1988	1	2,443	751	30.7%	868	35.5%
	2 i	13,055	2,242	17.2%	4,246	35.2%
	2 ii	11,670	2,096	18.0%	3,491	29.9%
	All classes	36,441	6,020	16.5%	9,997	27.4%

* Scientific and engineering research, design and development; scientific and engineering support services

Source: Universities Statistical Record (unpublished)

Table 5.5 Student load per full-time UGC funded member of departmental academic staff: (i) undergraduates

	1980/81			1981/82			1982/83			1983/84			1984/85		
	Undergraduate student load	Staff	Load per staff	Undergraduate student load	Staff	Load per staff	Undergraduate student load	Staff	Load per staff	Undergraduate student load	Staff	Load per staff	Undergraduate student load	Staff	Load per staff
Eng. & tech.	31,932	4,262	7.5	32,121	4,186	7.7	32,022	3,884	8.2	31,184	3,881	8.0	32,033	3,980	8.0
Agric. & vet.	4,425	772	5.7	4,403	755	5.8	4,371	705	6.2	4,226	694	6.1	3,833	662	5.8
Biol. Sci.	15,169	2,142	7.1	14,997	2,141	7.0	14,571	2,010	7.2	13,941	1,992	7.0	15,853	2,240	7.1
Physical Sci.	24,157	4,104	5.9	24,574	4,012	6.1	24,492	3,717	6.6	24,241	3,611	6.7	23,884	3,480	6.9
Math & comp.	23,062	2,296	10.0	23,939	2,323	10.3	24,548	2,212	11.1	24,369	2,218	11.0	25,123	2,324	10.8
All science	62,388	8,592	7.3	63,510	8,476	7.5	63,611	7,939	8.0	62,551	7,821	8.0	64,860	8,044	8.1
All subjects	257,088	33,989	7.6	259,367	33,475	7.7	256,227	31,390	8.2	250,909	30,859	8.1	257,587	30,833	8.4

	1985/86			1986/87			1987/88			1988/89		
	Undergraduate student load	Staff	Load per staff	Undergraduate student load	Staff	Load per staff	Undergraduate student load	Staff	Load per staff	Undergraduate student load	Staff	Load per staff
Eng. & tech.	32,067	4,087	7.8	32,582	4,153	7.8	33,449	4,173	8.0	33,910	4,093	8.3
Agric. & vet.	3,846	664	5.8	3,922	648	6.1	3,883	654	5.9	3,866	654	5.9
Biol. Sci.	15,776	2,243	7.0	15,911	2,244	7.1	16,472	2,257	7.3	16,538	2,204	7.5
Physical Sci.	23,316	3,513	6.6	22,724	3,498	6.5	22,072	3,405	6.5	22,087	3,183	6.9
Math & comp.	25,344	2,422	10.5	25,256	2,512	10.1	25,826	2,522	10.2	26,924	2,504	10.8
All science	64,436	8,178	7.9	63,891	8,254	7.7	64,370	8,184	7.9	65,549	7,891	8.3
All subjects	256,774	31,179	8.2	259,936	31,239	8.3	264,433	31,028	8.5	274,256	30,384	9.0

Source: USR University Statistics volume III

Table 5.5 Student load per full-time UGC funded member of departmental academic staff: (ii) taught postgraduates

	1980/81			1981/82			1982/83			1983/84			1984/85		
	Load	Staff	Load per staff	Load	Staff	Load per staff	Load	Staff	Load per staff	Load	Staff	Load per staff	Load	Staff	Load per staff
Eng. & tech.	2,794	4,262	0.66	2,660	4,186	0.64	2,654	3,884	0.69	3,030	3,881	0.78	3,022	3,980	0.76
Agric. & vet.	506	772	0.66	521	755	0.69	511	705	0.72	481	694	0.69	428	662	0.65
Biol. Sci.	520	2,142	0.24	513	2,141	0.24	522	2,010	0.26	592	1,992	0.30	777	2,240	0.35
Physical Sci.	1,050	4,104	0.26	965	4,012	0.24	1,055	3,717	0.28	1,093	3,611	0.30	1,114	3,480	0.32
Math & comp.	1,123	2,296	0.49	1,184	2,323	0.51	1,206	2,212	0.55	1,525	2,218	0.69	1,828	2,324	0.79
All science	2,693	8,542	0.32	2,662	8,476	0.31	2,783	7,939	0.35	3,210	7,821	0.41	3,719	8,044	0.46
All subjects *	20,681	33,989	0.61	20,876	33,475	0.62	20,944	31,390	0.67	22,329	30,859	0.72	24,690	30,833	0.80

	1985/86			1986/87			1987/88			1988/89		
	Load	Staff	Load per staff	Load	Staff	Load per staff	Load	Staff	Load per staff	Load	Staff	Load per staff
Eng. & tech.	3,353	4,087	0.82	3,367	4,153	0.81	3,138	4,173	0.75	3,266	4,093	0.80
Agric. & vet.	506	664	0.76	501	648	0.77	534	654	0.82	642	654	0.98
Biol. Sci.	717	2,243	0.32	794	2,244	0.35	771	2,257	0.34	858	2,204	0.39
Physical Sci.	1,048	3,513	0.30	1,119	3,498	0.32	1,078	3,405	0.32	1,064	3,183	0.33
Math & comp.	1,961	2,422	0.81	1,981	2,512	0.79	2,022	2,522	0.80	2,230	2,504	0.89
All science	3,726	8,178	0.46	3,894	8,254	0.47	3,871	8,184	0.47	4,152	7,891	0.53
All subjects *	25,947	31,179	0.83	26,346	31,239	0.84	26,582	31,028	0.86	29,150	30,384	0.96

Source: USR University Statistics volume III

* Excluding the Education subject group/cost centre

ANNEX A: PRICE INDICES

We used two separate indices to adjust cash figures to constant 1990/91 pounds, excluding the effect of inflation.

(i) GDP deflator

Data for the GDP deflator were taken from H.M. Treasury note SPE/M/0002/001, dated 20 March 1990, recalculated to 1990/91 = 100.000. From 1989/90 onwards, the data used were adjusted to eliminate the distortion introduced by the move from domestic rates to the community charge.

The following index was used.

1977/78	36.237
1978/79	40.113
1979/80	46.849
1980/81	55.443
1981/82	60.873
1982/83	65.268
1983/84	68.314
1984/85	71.707
1985/86	75.550
1986/87	78.116
1987/88	82.304
1988/89	88.166
1989/90	93.897
1990/91	100.000
1991/92	104.750
1992/93	108.416

The figures imply annual inflation rates of 6.5% in 1989/90, 6.5% in 1990/91, 4.75% in 1991/92 and 3.5% in 1992/93.

(ii) Universities Pay and Prices Index (UPPI)

Data for the UPPI deflator for all recurrent items were taken from *University Statistics 1988/89: III Finance*, appendix III, recalculated to 1990/91 = 100.0. UPPI is currently calculated at two points each year (January and July), but practice has varied in the past. The actual month is therefore indicated in the following description of the UPPI values used in this report; the month chosen is the nearest available to the midpoint of the April - March financial year in question.

1977/78	(July)	31.6
1978/79	(November)	35.6
1979/80	(November)	41.1
1980/81	(November)	54.2
1981/82	(November)	58.4
1982/83	(July)	61.6
1983/84	(July)	64.8
1984/85	(July)	68.1
1985/86	(July)	71.5
1986/87	(July)	76.2
1987/88	(July)	84.4
1988/89	(July)	89.4
1989/90	(July)	95.7
1990/91	(July)	100.0

APPENDIX 3

OTHER CONCERNS EXPRESSED BY THE SCIENTIFIC RESEARCH COMMUNITY

Academic salaries

1. Increases in the pay of university academic staff generally lagged behind that of other professional groups in the decade from 1978/79. For example, the stipend of the typical university lecturer, taken as 39 years old, increased by only about 10% in real terms (page 3 of Appendix 2) compared to an increase in the index of non-manual earnings of 35% (Department of Employment figures).

2. Although salaries at fixed points on the age-wage scale have varied little, the average age of academics has increased substantially over the decade and salary costs have remained a major element of the financial pressure on budgets despite the constraints on salary levels. Notwithstanding the drop in the number of UGC/UFC funded academic staff from 1981/82 onwards, an increasing proportion of UGC/UFC funding has still been spent on academic salaries since 1982/83 and this trend seems likely to continue.

Other budget pressures

3. For all the Research Councils, superannuation costs have also risen noticeably over the period covered by the SEPSU study (table 5.1). In addition, both they and HEIs have had to meet increased costs from reconstructing and upgrading buildings to meet new fire, health and safety regulations. These demands have increased, leaving proportionately less of the total budget to be spent at the research 'coal-face'.

4. The effects of pay and other budget pressures are reflected in the UPPI index. As previously noted, if this index is used rather than the GDP deflator the increases in DES funding have little more than kept pace with the increases in costs over the period 1977/78 to 1988/89.

Equipment costs

5. The ABRC has reviewed the current state of equipment in HEIs (all universities and a representative sample of polytechnics). The review, which was conducted by Policy Research in Engineering, Science and Technology (PREST) using a questionnaire technique, suggested that 86% of currently used equipment was at least adequate. This equipment was mainly supplied by funds from the UGC/UFC (46%) and the SERC (29%), other Research Councils and industry. The replacement value of the equipment was estimated to be £624m. Of this, 41% was less than 5 years old and 37% was over 10 years old.

6. However, only a minority of department heads considered themselves well-funded by international standards and the general opinion of respondents to the survey was that at least an extra £260m was required to support current research and a further £200m to equip future programmes. The main concern of researchers was that the cost of renewal plus necessary enhancement had increased much faster than the rate of general inflation, although this is hard to prove. For example, a rough analysis from the PREST Report, based on age and replacement cost, indicates that costs have risen at about the same rate as the retail price index. However, if the calculation is made on the basis of enhanced state-of-the-art equipment which is needed to maintain competitiveness, there is probably an additional cost over inflation of 5-10%.

7. The development of new techniques using sophisticated equipment has proceeded most rapidly in the biological science areas and funding for equipment there has caused particular problems.

8. Some respondents indicated that it was not large equipment they needed but more support for smaller items and consumables, ie for spending which was, then, most obviously to be supported from UGC/UFC funds. Even so, and in spite of all these difficulties, some respondents also indicated that they would give a higher priority to new staff than to new equipment.

Unfunded alpha-rated proposals

9. Table 5.3 shows that the Research Councils are unable to fund all the alpha quality research proposals which are submitted to them. For all the Research Councils in 1980/81, 86% by value of alpha-rated research grants were funded. By 1987/88 this had fallen to 62%. In many cases unfunded projects are of course re-submitted, and others still may go ahead on the basis of funding from UGC/UFC sources or external sources. It is therefore difficult to generalise on the impact of diminished first attempt success rates. An SERC study of alpha-rated projects between 1985/86 and 1988/89 indicated that, taking account of resubmissions and non-SERC funding, only 20% of such applications were ultimately not successful. The number of unfunded alpha-projects could also be a sign of the vigour and discrimination of the Science Base, emphasising still further that those projects which are selected are very good. In a Parliamentary Answer (22 January 1990, Col 493-4) the total value of the alpha-rated research grants funded for all five Research Councils was given as £185.5m. A further £87.5m would have been required to fund all alpha-rated applications in 1988–89 – some of it in grants to researchers with other successful applications.

Research Council spending on the Councils' own Laboratories and Institutes

10. Another concern which is frequently raised is the proportion of Research Council expenditure which is spent in the Councils' own Laboratories and Institutes. The work done in the Institutes, which mainly concerns AFRC and NERC, is not addressed further in this report, (although we note that the AFRC has announced a plan to increase the proportion of its core science budget spent in HEIs from 17% in 1988/89 to 30% in 1994/95). However, the SERC Laboratories, which exist to support research performed by HEIs, are necessarily a part of this discussion. The SERC figures on page 44 (Appendix 2) show that HEIs use a very high proportion of the time available on the Laboratories facilities (between 67% and 94% depending on the facility). Furthermore, the expenditure by SERC in its own Laboratories as a proportion of that spent in HEIs fell from 90% in 1977/78 to 45% in 1988/89 (Table 3.3). Despite these facts, there remains a concern over whether too much SERC money is being used to support its own Laboratories. The introduction of a common accounting base may assist future assessments of the value to HEIs of establishments with large facilities.

Size of research grants

11. There is concern that compared with ten years ago there may now be fewer small grants and less support for young scientists who have not established themselves sufficiently to obtain a Research Council grant. To some extent the gap has been filled by grants from charities and similar organisations, as well as by the Royal Society research grants scheme (figure 3.1). This scheme, which began in 1989 and which will be reviewed during the three years of initial funding, awards grants up to a normal maximum of £10,000. Also, both AFRC and NERC have undertaken initiatives to meet the special needs of young or new researchers. There are no figures to show whether changes in the availability of small-scale support have had a negative influence over the ten year period, but it remains an issue that still causes anxiety and which deserves further attention.

More dirigiste research funding

12. There has been an increasing trend in the Research Councils towards funding proposals for 'directed' programmes. Many researchers are concerned that this may favour proposals of poorer quality than responsive mode proposals in 'undirected' areas. However, such areas are chosen in close consultation with the scientific community and often reflect the emergence of new scientific opportunities (eg protein engineering). They may, therefore, attract the most adventurous scientists, also following their own inclinations. The identification of such programmes, within which resources may then be allocated in the responsive mode, is also an important element of research selectivity. The figures for the SERC show that over the last few years the proportion of grant funding between undirected and directed programmes has been at a ratio of around 1:1 for the Science Board and 3:7 for the Engineering Board.

13. There are also concerns that increased funding of the Science Base from industry and Government departments might lead to more dirigiste research programmes since such funding will normally be aimed at achieving objectives set by the company or department. However, such support can lead to valuable interaction with industrial scientists, and work aimed at improving the scientific understanding of industrial processes is an important part of technology transfer.

Relative decline in support for basic science

14. Dependent upon the research policies adopted by the HEIs, there are concerns in some quarters that an increased proportion of Science Base funding being provided by industry could lead to an increase in applied research at the expense of basic or pure research. It could also create an imbalance in the type of basic research performed in favour of those areas which are of most interest to industry and charities, although to some extent the Research Councils can counter this tendency by placing more emphasis in other areas. Increases in funding from industry should therefore be seen as a valuable addition to, but not a substitute for, sufficient public funding of basic research.

Relative decline in support for core science

15. There is some evidence of a relative decline in recent years in the Science Base funding for core sciences; the proportion of SERC funds allocated to its Science Board having declined from 32% in 1980/81 to 27% in 1988/89. However, 27% still represents a rise from the 1977/78 figure which was only 23%. The perception of a decline in support for core sciences may therefore arise more from the erosion of the dual-support system, as noted above, than from any policy changes.

Ageing of university staff

16. The skewed age profile of permanent university staff (Figure 4.4(iii)) is a matter for concern in all subjects despite the alleviation following the New Blood Scheme and the New Academic Appointments Scheme (the first year of which led to a lowering of the average age of staff, with an increase in the proportion under 35). The increase in average age is most pronounced in scientific faculties (figure 4.4(ii)). This could have been expected to have an adverse effect on the quality of scientific research. No evidence for this has been apparent, perhaps because of the effect of increasing numbers of young, short term, staff funded from non-UFC sources (figure 4.2(v)).

Migration of academic staff

17. Data on migration of academic staff show that in every year since 1983/84 there has been a net inflow into the UK. By grade, however, there are marked differences and there is a consistent outflow of staff in the reader/senior lecturer grades. There is no evidence of a net loss of professorial staff. In fact, according to the latest USR figures in 1986 there was a net gain

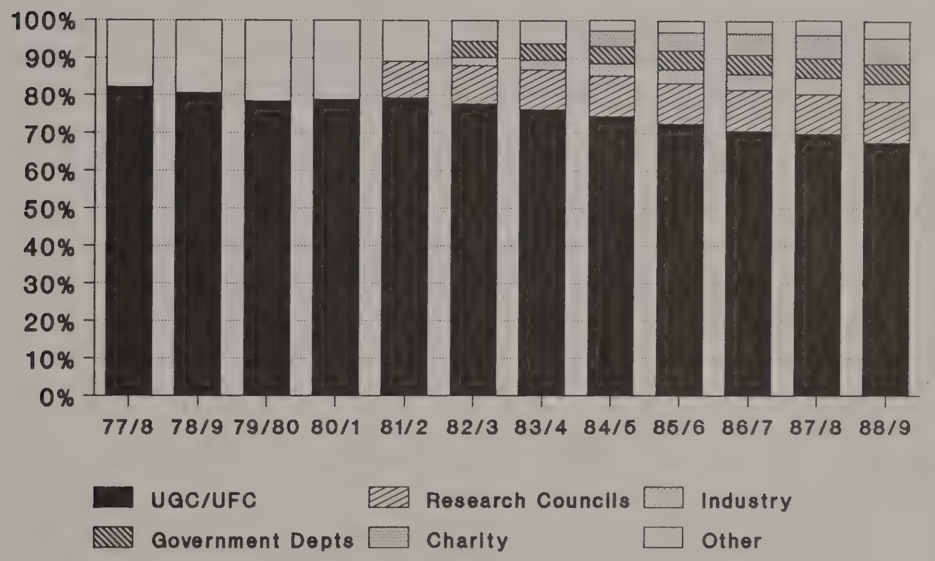
of such people. However, there are difficulties in compiling figures on the migration of academic staff and they do not include, for instance, postgraduate students who take up their first academic appointment abroad, some of whom return later and appear in the statistics as part of the inflow. There also remains a concern over the loss of a relatively small number of key people. Further work on this issue might therefore be needed.

THE CASE FOR INCREASED PUBLIC FUNDING OF UNIVERSITY RESEARCH

Background

1. Whether measured in terms of staff numbers or total research income, the UK Science Base has undoubtedly grown over the past decade. However, the way in which it has grown has placed undue strains on the funding of universities and is of considerable concern. It could be argued that universities have invited their problems by committing themselves to too much research given the resources at their disposal. However, it is neither practical nor desirable drastically to reduce the volume of academic science. It is in the national interest to restore the balance of resources compared to research activities and to ensure that procedures are introduced which will maintain that balance.

Figure F - University Research Income - Proportions from Various Sources



Funding sources are included in 'Other' where no specific breakdown is available

Source: SEPSU Tables 2.4 and 2.7

2. As Government funding of the rapid expansion of academic science slowed in the 1970s, universities were encouraged to seek additional funding from other sources and have enjoyed considerable success in doing so. This is illustrated in Figure F which shows income received by universities (and which therefore excludes Research Council expenditure in own establishments). The proportion of university research income from these other sources is now twice that received from the Research Councils. The contribution to research from UGC/UFC sources has also fallen from 82% of universities' total research income in 1977/78 to 68% in 1988/89, and looks to fall further.

3. In order to carry out the growing volume of research funded from non-UFC sources, many more short term research assistants have been employed by the universities. These extra staff draw upon the university for support activities, such as computing, workshops and other central facilities, as well as amenities such as power, telephones, and office and laboratory space. In many cases the university administration has had to expand to process the increasing number

of research contracts. The increase in staff numbers has inevitably involved refurbishment of existing buildings, and even capital expenditure on new ones. The difficulties caused by the strained infrastructure are experienced by all staff.

4. The indirect costs of contract research are difficult to quantify and the recovery rate, although improving, has been poor. Indeed, the recent CVCP/ABRC study raised doubts as to whether even the full direct costs have been adequately covered. This will need to improve sharply, the more so if account is to be taken of the recurrent and capital costs of new and existing buildings.

5. In effect, all research contracts have been subsidised by UGC/UFC funds, and the consequent loss of financial flexibility to universities has been considerable.

6. Better and rapid recovery of indirect research costs will therefore help greatly to prevent further damage to the research infrastructure. Even so, more financial assistance will be needed to restore university laboratories to the well-found state, and to meet the costs of numerous legislative requirements of the last decade. The arguments that follow in favour of additional funding are not mutually exclusive. They give rise to a range of estimates of increases in Government funding of academic science that may be desirable.

7. Many current issues concerning the management and organisation of science will undoubtedly persist in future years. The public debate has addressed, and must continue to address, the difficulties of meeting rapidly changing scientific priorities within a constrained envelope of resources, and in particular the need for:

(a) continuing selectivity in funding to ensure that target areas are properly supported;

(b) research staff to change fields more readily;

(c) better use of personnel, and planning of their careers as well as changes to terms and conditions of employment;

(d) more efficient administration and more accountable financial management of research activities;

(e) a greater diversity of organisational structures as HEIs develop niche positions.

UGC/UFC funding for research

8. The element of UGC/UFC funding estimated to have been spent on scientific and technological research in 1979/80 was £683m in 1990 pounds (£320m in cash terms). This increased to £735m in 1987/88, but dropped back to £690m in 1989/90 and was planned to fall to £600m by 1992/93. These figures do not take account of any transfer of funds from the UFC to the Research Councils. The 1992/93 figure of £600m is **£135m** below the peak figure in 1987/88 and **£83m** below the 1979/80 figure.

Recovery of indirect costs from Government departments

9. Government departments have typically refused to pay much, if anything, towards the indirect costs of the research they commission from universities. In 1988/89, the total income received by universities in the form of research grants and contracts direct from Government departments was £105m. At the 60% overhead rate recommended in the Hanham Committee review, this implies an underpayment by the departments for services rendered of up to **£63m** per year. As indicated previously, we believe that this underpayment should be remedied by the Government departments concerned paying full costs in future. If they cannot or will not, then compensating increases from HEFC sources may be desirable.

Unfunded alpha–rated science

10. The extra sum that would have been needed by the Research Councils to fund fully their alpha-rated grant applications in 1988/89 was **£87.5m**. However, given the continuing growth in scientific opportunities, it may be that not all alpha-rated grant applications can be so supported. Furthermore, some unfunded alphas are eventually funded, either by resubmission of the grant application or from some other source. This implies that the actual shortfall is less than the £87.5m. At the same time, the problem may be under-stated because of self-denial. Academics in some fields are no longer applying to the Research Councils for grants because they believe their probability of success is now so low; others may be increasing their applications to improve their chance of success.

Health and Safety and other regulations

11. A number of new regulations require HEIs to undertake significant investment in new equipment and building alterations. For instance, the UFC has estimated that a sum of **£70m** will be required by universities for compliance with the Animals (Scientific Procedures) 1986 Act. The DES had agreed to make some provision towards these additional costs, although the balance would need to be found from UFC Funds.

12. University buildings have always been subject to building regulations (including those relating to access for the disabled). No additional capital resources are given for this purpose, and as the regulations are extended or made more onerous, the cost of compliance increases, and the resources available to the universities are stretched even further. A similar effect is occurring with other legislation, such as:

(a) Control of Substances Hazardous to Health (COSHH 1989);

(b) Code of Practice for the Prevention of Infection in Clinical Laboratories and Post-mortem Rooms (HOWIE 1979);

(c) The Health and Safety at Work Act;

(d) Legislation regarding the Means of Escape and General Fire Prevention/Precautions;

(e) New British Standards on various products and procedures eg these relating to fume cupboards;

(f) The Electricity at Work (1990) Regulations.

13. Changes in working practice such as those required by the need to comply with Good Laboratory Practice (GLP) may also increase the operating costs of performing research in certain areas by, for instance, requiring a minimum number of people to be present in a given laboratory while work is in progress.

Equipment

14. The survey of academic research equipment referred to in paragraphs 5 and 6 of Appendix 3 suggested that **£260m** of additional equipment would be needed to support current British research at the world-class level, and a further **£200m** to enter planned new areas of research. Whilst these figures represent asserted rather than proven requirements, they suggest that some increase in funding for equipment is desirable.

Studentship Awards

15. In 1989/90, the total number of studentships (for both PhDs and one-year Master's degrees) funded by the five Research Councils was about 13000. The average studentship award stood at £3725 (exclusive of special allowances); this contrasts with the figure of £7331 paid to postgraduates funded by the Wellcome Trust. The Wellcome Trust has also adopted

the practice of giving incremental increases to postgraduates in their second and third years whereas Research Council studentships are not differentiated by year.

16. The cost of increasing the Research Council studentship award to the level paid by the Wellcome Trust would be **£47m** to cover all students, or **£36m** to cover research students only. To introduce an award pay-scale so that research students received increments of £500 in both second and third years would cost an extra **£5m**.

Value Added Tax

17. The CVCP have estimated that the recent rise in the rate of VAT to 17.5% will add **£35m** to the annual operating costs of UK universities.

Public expenditure on the Science Base as a proportion of total national wealth

18. It could be argued that the share of the total national wealth invested in the Science Base should not be allowed to decline.

19. Over the five years from 1980/81 to 1984/85, the average total DES funding for the Science Base stood at 0.324% of the GDP. Over the following five years, the average fell to 0.293% of GDP. The Science Base has therefore not benefitted proportionately from the recent growth in national wealth. By 1992/93, we estimate that the national contribution to the Science Base will have fallen to around 0.25%.

20. If total DES funding for the Science Base had been maintained at 0.324% of GDP then, in 1989/90, a sum of £1623m would have been needed – **£159m** more than was actually provided.

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Substantial changes have taken place over the past ten years in the funding and organisation of academic science. This report by the Advisory Council on Science and Technology (ACOST) considers the effect of these changes on science and technology research in universities – a major component of the UK Science Base.

Rapid growth in scientific opportunities in addition to research costs rising faster than general inflation have contributed to continuing pressure on the budgets for Science Base research in universities. The need for universities to identify and recover the full costs of research sponsored by external agencies including industry, Government departments and charities has added to these budgetary pressures.

The report recommends that a number of measures be taken in order to place future academic research on a sound financial basis. The report further recommends that Higher Education Institutions examine the career structure for academic researchers in science and technology.

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